

Public Perception of Safety Messages and Public Service Announcements on Dynamic Message Signs in Rural Areas

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16. Abstract The objective of this project was to assess the effectiveness and potential benefits of posting public service announcements (PSAs) in rural areas by surveying a variety of travelers in those areas, including local residents, tourists, and long-haul truck drivers. This project addressed a number of questions related to safety awareness and PSA messages on dynamic message signs (DMS), including: driver awareness, driver understanding, changes in driver behavior, and drivers' opinions. Study findings provide an understanding of the usefulness and effectiveness of using DMS for safety and PSA campaigns, providing a basis for recommendations to influence and/or improve agencies' guidelines, policies and operations on using DMS as a tool for safety and public service campaigns.					
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EXECUTIVE SUMMARY

Transportation agencies are frequently asked to post public service announcements (PSAs), such as seat belt laws or announcements concerning upcoming events on dynamic message signs (DMS) when they are not being used for transportation-related purposes. However, there are some concerns that these messages are not understood by travelers and may actually be a distraction. Further, the effectiveness of such messages in influencing motorists' travel behavior and actions (e.g. choice of route, mode, or time of date for travel) is not well understood.

The objective of this project was to assess the effectiveness and potential benefits of posting PSAs in rural areas by surveying frequent and infrequent travelers on those corridors, as well as truck drivers. This project addressed a number of questions related to safety awareness and PSA messages on DMS, including traveler awareness, understanding, changes in behavior, and opinions. Intercept surveys were conducted at rest areas and truck stops to collect public feedback regarding safety messages and PSAs on DMS posted by five agencies in four study corridors.

Analysis was conducted on specific hypotheses for each of the evaluation areas of awareness, understanding, behavior changes and traveler opinions. General and site-specific statistically significant findings from this study show:

- Awareness: Approximately 77 percent of travelers encountered by the survey team during the screening interview had seen a DMS, while 79 percent of all survey respondents indicated that they had observed at least one of the safety-related messages. Generally, infrequent travelers had higher levels of awareness, followed by frequent travelers, while truckers had the lowest awareness level.
- Understanding: Over 79 percent of travelers were able to correctly interpret the presented message: in Nevada, truckers were found to have a significantly lower understanding level than infrequent and frequent travelers; in Missouri, infrequent travelers' understanding of the identified message was significantly lower than frequent travelers. An even higher percentage (92 percent) of respondents agreed or strongly agreed that the message displayed in the corridor was understandable; in both Kansas and Nevada, infrequent travelers were more likely than frequent travelers or truckers to consider the message as understandable. Most respondents (96 percent) found messages displayed at other sites to be understandable as well.
- Behavior changes: Approximately 23 percent of travelers reported changing their driving behavior after seeing the specific posted safety message in the study corridors; however *54 percent of respondents indicated that seeing safety campaign messages on DMSs in the past had caused them to change their driving.* While 23 percent of survey respondents reporting behavior changes after reading the specific safety message may seem low, given a generally safe traveling public, e.g., high compliance rates with seatbelt use, this finding is not surprising. Infrequent travelers at most sites were significantly less likely to change their driving behavior because of the safety-related DMS messages. Young travelers and female travelers in Kansas were more likely to change their driving because

of the DMS messages. Generally, travelers observing DMS less frequently were less likely to change their driving behavior. The survey data also indicated that the display of a PSA on a DMS is unlikely to cause travelers to slow down to read the message, with 18 percent of respondents reporting that they or drivers around them slow down to read these DMS messages. In Minnesota/Wisconsin and Nevada, infrequent travelers were significantly less likely to respond that the safety-related DMS messages cause them to slow down to read the message than frequent travelers and truckers.

- Traveler opinions:
 - A high proportion of travelers believed that the specific safety message posted at each survey site was appropriate (90 percent) and raised their awareness of the safety issue (71 percent). The only statistical significant findings for appropriateness were that younger travelers were significantly less likely to consider the messages to be appropriate than older travelers in Kansas, Minnesota/Wisconsin and Missouri, while the opposite was found in Nevada. Regarding raising awareness, the only significant differences were in Kansas where females and travelers seeing DMS frequently were more likely to think the messages raise their awareness of the safety issue.
 - Just six percent of respondents indicated that only traffic-related messages should be shown on DMSs. Impact by traveler type was not statistically significant, but younger travelers tended to be more likely to think the DMS should only display traffic message and these differences were statistically significant in both Kansas and Missouri.
 - Finally, most travelers considered DMS as the best way of communicating safety-related information to the public; significant impacts were only observed in Minnesota/Wisconsin where infrequent travelers had a significantly higher probability of thinking DMS was the best way to communicate safety-related information than truckers.

These study findings provide an understanding of the usefulness and effectiveness of using DMS for safety and PSA campaigns. This analysis supports displaying public service announcements and safety messages on DMS in rural areas given 73 percent of surveyed travelers in rural areas support the use of DMS to display PSAs and safety-related information in general, and 73 percent also think DMS are the best way to communicate that information. Findings validate current agency practices in the survey corridors for displaying safety messages and PSAs on rural DMS.

The findings of this study also suggest that displaying safety messages and PSAs more frequently would not be detrimental. While 23 percent of survey respondents reporting behavior changes after reading the safety message on the DMS may initially seem low, given high compliance rates, e.g., with seatbelt use, this is expected. Even a small percentage of travelers changing their behavior could result in a positive influence on safety, and many responding that they did not change their behavior noted anecdotally that reading the safety message made them more conscious of driving in a safer manner.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
DMS	Dynamic Message Sign
DOT	Department of Transportation
FHWA	Federal Highway Administration
KS	Kansas
MN	Minnesota
MO	Missouri
NV	Nevada
PCMS	Portable Changeable Message Sign
PSA	Public Service Announcement
TMC PFS	Transportation Management Center Pooled Fund Study
WI	Wisconsin

CHAPTER 1. INTRODUCTION

Transportation agencies are frequently asked to post public service announcements (PSAs), such as seat belt laws or announcements concerning upcoming events on dynamic message signs (DMS) when they are not being used for transportation-related purposes. However, there are some concerns that motorists may not fully understand these messages. These messages may also be a distraction to drivers and result in slow-downs and the potential for queuing, creating mobility and safety hazards. In addition, the effectiveness of such messages in influencing motorists' travel behavior and actions (e.g. choice of route, mode, or time of date for travel) is not well understood. For example, does the seat belt campaign message change the behavior of motorists and result in greater compliance to the seat belt laws? Is such behavior change short or long term?

An earlier study focused on public acceptance and recognition of safety and PSA messages as well as the effectiveness of the messages on traveler behavior changes in large metropolitan areas, primarily commuters and drivers traveling within the metropolitan areas. In light of the results of the report of "Effectiveness of Safety and PSA messages on DMS"¹, several questions from the traffic operations standpoint arose:

- Are the study results in metropolitan areas applicable in rural areas considering the different traffic operating characteristics on rural highways (density, higher speed, higher proportions of truckers and non-commuters, etc.)?
- Do the messages have similar or different influences on rural highway drivers since we would expect a higher percentage of drivers traveling on rural highways are truckers and non-local travelers?
- Do travelers, particularly younger and less experienced drivers, pay less attention to messages on DMS in rural areas than urban areas?

This study sought to address those questions through a field evaluation focused on rural roads. The objective of this project was to assess the effectiveness and potential benefits of posting PSAs in rural areas by surveying frequent and infrequent travelers on the corridor, and long-haul truck drivers. This project addressed a number of questions related to safety awareness and PSA messages on DMS, including: traveler awareness, traveler understanding, behavior changes, and traveler opinions.

Study findings provide an understanding of the usefulness and effectiveness of using DMS for safety and PSA campaigns, providing a basis for recommendations to influence and improve agencies' guidelines, policies and operations on using DMS as a tool for safety and public service campaigns.

This study was supported by the Transportation Management Center Pooled Fund Study (TMC PFS), and members of five State agencies specifically assisted with the coordination and execution of data collection on the four study corridors within their States shown in Figure 1.

¹ Report can be found at: <http://www.ops.fhwa.dot.gov/publications/fhwahop14015/>



Figure 1. Map. The Study Corridors.

This report is intended to provide insight for agencies making decisions about the potential benefits and tradeoffs of posting PSA messages on DMS. This document is organized into the following sections:

- *Survey Design Methodology* describes the experimental design, survey design and sample frame, data collection methodology, and design and testing of the survey.
- *Traveler Intercept Survey Data Collection* presents information on survey preparations and execution, and site descriptions of survey locations.
- *Analysis Methodology* describes the selected approach for analyzing the collected data.
- *Findings and Recommendations* discusses the results and findings, and provides recommendations to practitioners.

CHAPTER 2. SURVEY DESIGN METHODOLOGY

A Survey Design and Execution Plan was developed in January 2015 to describe the methodology for experimental design and conduct of traveler intercept surveys. The purpose of the Survey Design and Execution Plan was to describe the following elements, which are also presented in separate sections below:

- Experimental Design.
- Survey Design and Sample Frame.
- Data Collection and Survey Procedures.
- Design and Testing of the Survey Instrument(s).

EXPERIMENTAL DESIGN

The overall concept of the experimental design for assessing the public perception of safety messages and public safety announcements (PSAs) on dynamic message signs (DMS) in rural areas was to employ a “short recall,” “event-based,” experimental design combined with a traditional retrospective recall survey method. Travelers on different highways were asked general questions regarding safety messages and PSAs on DMS that could be answered based upon their cumulative history of experiences and observations of these types of messages. These same travelers were also asked about specific messages that were presented to them as they traveled down the highway of interest. This design provided a mechanism to estimate the visibility, awareness, and comprehension separately from overall opinions of these types of messages. Each traveler provided information that could be used to calibrate the survey responses based upon their immediate experiences as opposed to those formed over a longer time under unknown conditions.

SURVEY DESIGN AND SAMPLE FRAME

The focus of this study was to gather information from all types of travelers regarding their awareness and perceptions of messages on DMS on predominantly rural highways. The population of interest was all travelers of the highways including tourists, local travelers and commuters, and commercial operators.

One of the key components to a statistically based survey design is determining the appropriate sampling frame from which to draw “samples” or respondents. In this project, responses across all aspects of the population of travelers were desired, which would imply that the ideal sampling frame would be a list of all persons who (or previously) traveled on the highways of interest.

This project employed an intercept survey to identify travelers and operators of motor vehicles along the highways of interest. The intercept survey’s sampling frame consisted of all vehicles that were traveling along the highways of interest during the data collection window. It relied upon the assumption that the vehicles observed during the data collection period were representative of all vehicles/travelers on the highway segments. A proportion of the true

sampling frame would not stop at any of the proposed intercept locations, or even at all, and was therefore not available to survey. The potential bias if this portion of the sampling frame has systematically different views of DMS was a limitation of the intercept survey that had to be tolerated. The other potential biases due to the locations, timing and types of travelers intercepted can be mitigated through management of the data collection periods, number of travelers intercepted, and the avoidance of unique travel events such as peak holiday travel periods.

Generally, it was expected that surveys were going to be conducted at rest areas, truck stops, and high-volume exits to intercept local travelers, tourists, and commercial operators. State department of transportation (DOT) representatives recommended specific locations to intercept travelers for conducting the survey. More information about the corridor and survey locations is described in the Site Descriptions subsection regarding Traveler Intercept Survey Data Collection.

Sample size calculations were performed to quantify the exact number of travelers that need to be intercepted and surveyed for desired statistical power. In total, it was assumed that a total of 1,920 completed extended questionnaires would be collected across the four corridors.

Table 1 shows an analysis of sample size requirements for detecting specified differences in the true population proportions of two groups of travelers (e.g., comparing the percentage of travelers on I-44 who “strongly agree” that PSAs on DMS are not distracting to those travelers on I-70 that “strongly agree” to the same question). The expected number of 480 completed extended questionnaires per corridor would be sufficient to detect differences as small as 10 percent in the opinions of travelers between any two of the corridors being studied with at least 80 percent statistical power. Statistical power is the probability that the specified difference in populations, if such a difference truly exists, will generate a survey response that correctly concludes a difference between the two populations. The power calculations here were performed in StatXact and are based on a two-sample fisher’s exact test comparison of proportions with a Type 1 error rate of 5 percent (probability of erroneously rejecting a hypothesis of difference). The analysis was completed around the most conservative assumption that the two proportions being compared averaged 0.5. This analysis provides assurance that the number of surveys is adequate to statistically identify reasonably modest population response differences (i.e., 10 percent+). If ability to detect smaller differences were important, larger sample sizes would be required. Smaller sample sizes would permit the identification of only very large population differences.

Table 1. Preliminary Sample Size Requirements for Comparing Differences in Traveler Opinions Between Two Corridors.

Statistical Power	Sample Size in Each Group Required to Detect Difference of:		
	10%	12.5%	15%
80%	416	265	191
90%	546	346	244
95%	664	428	296

DATA COLLECTION METHODOLOGY

A qualified team of interviewers was deployed to intercept the required variety and number of travelers at each site, according to the Survey Design and Execution Plan. Each data collection team employed a six-step process to survey travelers:

- (1) Intercept;
- (2) Determine eligibility;
- (3) Recruit;
- (4) Complete the main questionnaire;
- (5) On-site review of data quality;
- (6) Distribute incentives.

The two team members each conducted two primary responsibilities. First, the team member served as a “screening interviewer” to intercept travelers, determine eligibility, and recruit travelers. After confirming eligibility, the team member served as “questionnaire administrator” to oversee the completion of the main questionnaire, perform on-site data quality procedures, and distribute the incentives. These specific responsibilities are illustrated in Figure 2 and described in greater detail below.

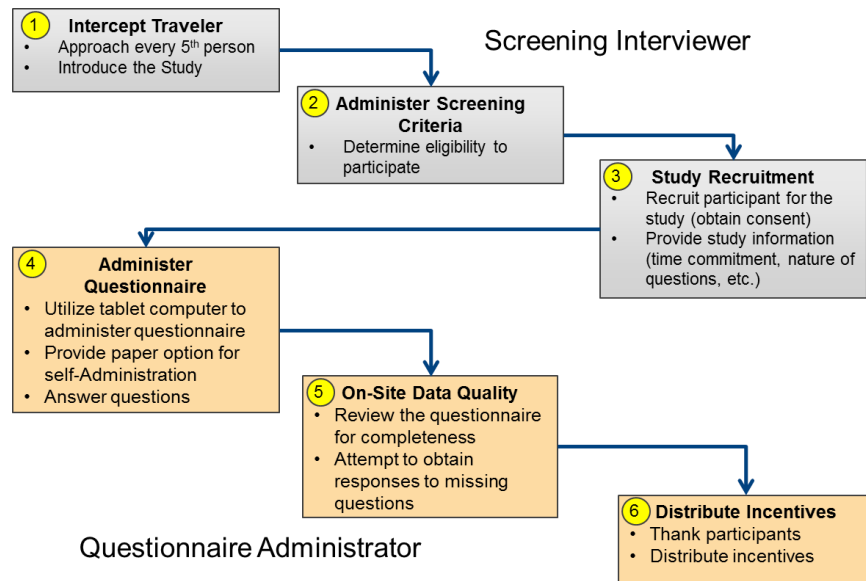


Figure 2. Chart. Responsibilities for Survey Administration.

The screening role included the “intercept” and initial recruitment of travelers, i.e., approaching and holding the initial contact with potential participants. Based upon the actual, very low sampling conditions at the rural corridor locations, team members approached every person of driving age as a potential survey participant. Upon approaching a potential participant, the screening interviewer introduced himself or herself, gave a brief explanation of the study, and asked the traveler if he or she had seen a DMS on the corridor, while showing the traveler a picture of a DMS. Generally, travelers were eligible to complete the main questionnaire if they drove along the corridor and had the potential to observe a safety message/PSA. Travelers that had not recently seen a DMS on the corridor with a posted message were deemed ineligible. However, language issues, deafness, or other difficulties that would prohibit the completion of the main questionnaire resulted in ineligibility. Regardless of the eligibility determination, a “disposition” code was entered onto each form to indicate the results of the screening. Examples of disposition codes include (ineligible, eligible, language barrier, etc.).

If the traveler met the eligibility requirement described above, he or she was recruited to complete the main questionnaire. In general, this was not a scripted dialog, but the team member covered these key elements. The key elements included: additional details on the study, an

estimated time for completion (the main questionnaire took about three to five minutes to complete), and mention of the incentives.

If successful in recruiting the traveler, the traveler was provided an iPad, which had the questionnaire loaded, using the QuickTap Survey application. The team member assisted the traveler completing the questionnaire on the iPad and was available for answering questions from participants in the process of completing a questionnaire.

After completion of the questionnaire, the questionnaire administrator reviewed the questionnaire on the iPad for completeness. The participant was unable to skip questions given the design of the survey in the QuickTap Survey application, but some participants might have thought they were finished before completing the survey. The review was conducted to ensure that the respondent did not inadvertently skip remaining survey questions. If skipped questions were identified, the team member would attempt to question the respondent to obtain the response.

To encourage a high response rate from travelers, the survey administrators remained professional and courteous at all times. Interviewers dressed appropriate for the weather in clothing that was not offensive to others. Appropriate measures and procedures were followed to assure the safety and security of survey administrators. The use of incentives was determined with input from both Federal Highway Administration (FHWA) and the local agency staff. The incentives given included candy, chips, and bottled water and soda. Following the successful completion of a main questionnaire and subsequent review, the questionnaire administrator was responsible for distributing the appropriate incentives.

DESIGN AND TESTING OF THE SURVEY INSTRUMENTS

Information was collected from travelers using two different survey instruments: a screening instrument (screening questionnaires) and a more extensive questionnaire (main questionnaire). The screening questionnaire was very brief, interviewer administered, and completed by a larger portion of travelers. The main questionnaire was self-administered using the QuickTap Survey application on an iPad, collected more information, but given only to a subset of travelers. The objective of the screening questionnaire was to assess eligibility, which was determined by the traveler's awareness of an upstream DMS displaying a message. The objective of the main questionnaire was to capture more in-depth observations and opinions on the types of PSAs, the readability, the observed traffic impact, etc.

Defined study hypotheses and measures of effectiveness (see Table 2) guided the development of survey instruments. The screening instrument was a paper form and the main questionnaire resided in the QuickTap Survey application on an iPad. Importantly, the execution of the survey coincided with the posting of planned messages on the DMS. Showing travelers a static image of a DMS from the area facilitated the visual association between the message sign.

Table 2. Initial Hypotheses and Survey Measures.

Evaluation Area	Hypotheses	Evaluation Measures
Awareness	A significant percentage of travelers are aware that safety messages and PSAs are included on DMS	Percentage of respondents aware of PSAs posted on DMS
	A significant percentage of travelers have observed an actual safety message and/or PSA on a DMS	Percentage of respondents reporting seeing a PSA on the traveled corridor
Understanding	Drivers can understand the messages on the DMS	<ul style="list-style-type: none"> • Percentage of respondents indicating that they “Agree” or “Strongly Agree” that they understand the sign • Percentage of respondents that can provide the “correct” interpretation of an example PSA.
	Drivers understand the difference between a PSA and a “normal” message	Percentage of respondents that can identify “normal” DMS messages from PSA messages
Behavior Changes	The display of a PSA on a DMS does not cause traffic to slow down or other congestion	Percentage of respondents who indicate that they “slow down” or are slowed down by other traffic to read the DMS
	The contents of the PSA cause a change in behavior by the travelers (e.g., more aware, looking for an AMBER alert license plate, etc.)	Percentage of respondents that indicate that they “Agree” or “Strongly Agree” that they have changed their behavior as a result of observing the PSA
Opinions	Travelers believe that DMS for safety awareness and PSA messages is appropriate	Percentage of respondents that indicate that they “Agree” or “Strongly Agree” that DMS for safety awareness and PSA messages is appropriate
	Travelers believe that DMS should only be used for traffic-related messages	Percentage of respondents that indicate that they “Agree” or “Strongly Agree” that DMS should be only used for transportation-related messages
	Travelers believe that it would be more effective and/or less distracting to motorists to disseminate safety awareness messages and PSAs via other means	Percentage of respondents that indicate that they “Agree” or “Strongly Agree” that other methods would be more effective and/or less distracting
	Travelers perceive a value of safety awareness and PSA messages on DMS	Percentage of respondents that indicate that they “Agree” or “Strongly Agree” that they see value in including safety awareness and PSA messages on DMS

The survey instruments were developed in multiple waves: First, a rough draft of the concepts and layout of the survey instruments were developed. Second, a draft version of the survey instruments was prepared within the QuickTap Survey application. A small pre-test of the survey instruments was conducted to identify timing issues, flow of the survey, understanding and comprehensibility, etc. on eight individuals. Following this pretesting of the questionnaire and prior to the data collection initiation, all messages and other corridor-specific information were updated to reflect that site's posted messages, etc.

CHAPTER 3. TRAVELER INTERCEPT SURVEY DATA COLLECTION

This section presents background information about the data collection process and sites where survey work was conducted. Traveler intercept surveys were conducted at rest areas and truck stops to collect public feedback regarding safety messages and public service announcements (PSAs) posted by five agencies on dynamic message signs (DMS) in four study corridors.

Summary information is presented first, with additional details about survey work provided in separate sections below for each of the four study corridors listed below:

- Kansas: I-70 between Topeka and Salina (100 miles with 20 DMS).
- Minnesota and Wisconsin: I-94 between Madison, WI and Saint Paul, MN (250 miles with 14 DMS).
- Missouri: I-44 between St. Louis and the Oklahoma state line (280 miles with 31 DMS).
- Nevada: I-80 between Fernley and Wells (310 miles with 13 DMS).

SURVEY PREPARATIONS AND EXECUTION

This section describes the survey preparations employed in this project, including the coordination and feedback with each State department of transportation (DOT) point of contact to help the survey team identify survey locations. Lessons learned from the field, including anecdotal observations by the survey team and factors that may have influenced the survey are also presented.

Feedback received from State DOT representatives from each of the four study corridors, the Transportation Management Center Pooled-Fund Study (TMC PFS), and the Federal Highway Administration (FHWA) was used as the foundation for planning and preparations for conducting traveler intercept surveys. Information was gathered about how and when the State DOTs in the study corridors post safety messages, and a Survey Design and Execution Plan was developed to document how the surveys would be conducted. With some minor exceptions as noted below, the practices presented in the Survey Design and Execution Plan were followed in the field.

Battelle worked to coordinate travel to the four corridors to conduct surveys at times when a safety campaign was being conducted along the study corridors. Coordination with each State DOT point of contact was conducted prior to the site visit. These discussions helped the survey team determine the specific messages that would be posted on the DMS, when they would be posted, appropriate sites for conducting surveys, and also allowed the point of contact to review the corridor-specific questions that would be asked on the surveys. The survey questionnaires for each site are presented in Appendix A.

In the field, a two-person survey team was used to conduct surveys at all times, except for three days on the first survey collection trip in Nevada when a third survey team member was present. The survey team made concerted efforts to conduct surveys at times that would gather the most

responses, using multiple locations for each corridor in the first round of surveys, and returning to locations that had the highest survey respondents for subsequent rounds of surveys. Several lessons learned from conducting surveys should be noted. First, while the survey team and iPad app-based instruments used in the field allowed for potentially high numbers of travelers to be surveyed, the generally rural nature and low traffic volumes of these corridors limited the number of survey participants. In anticipation of this, as well as other potential issues that could have arisen in the field, more survey days were added for each corridor beyond what had been initially planned, and additional site visits to collect surveys were necessary. Specifically, two days of surveying had been proposed for each corridor, but over 30 full days of surveying were necessary to collect the number that had been initially estimated for all corridors.

In addition, the initial intent of conducting surveys was to capture equal numbers of frequent travelers, infrequent travelers, and truckers. However, in the field it was quickly realized that, given low traffic volumes, it was necessary to intercept every traveler regardless of traveler type. Further, locations with higher percentages of frequent travelers or truckers, e.g., truck stops, resulted in fewer intercepts, and thus a much lower number of participants overall. Surveying more often at rest areas may have resulted in a higher number of infrequent travelers, but almost certainly resulted in similar or greater numbers of truckers and frequent travelers than would have been achieved at an off-interstate location (that would also include a mix of travelers not even on the interstate corridor). This approach also provided a higher number of survey participants overall.

A variety of safety campaign messages were posted on the four corridors while the surveys were being conducted in May, July, September, October, and November. Given the number of days required to conduct surveys in each corridor, and the limited periods of time that some States post safety messages on DMS, it was not always possible for the messages to be consistent for multiple visits within the corridor.

This study sought to understand the perceptions of three different types of travelers:

- Infrequent travelers (i.e., travelers that utilize the highway less than once per month).
- Frequent travelers (i.e., travelers that utilize the highway at least once per month).
- Commercial vehicle operators.

Overall, a total of 1936 travelers were surveyed across the 4 corridors, including 784 infrequent travelers (40 percent of responses), 623 frequent travelers (32 percent of responses), and 529 commercial vehicle operators (27 percent of responses).

The survey team logged estimated demographic information (male vs. female and three estimated age categories) as well as reasons that people declined to take the survey (eligible and refused, did not see the message sign, etc.). In addition, the survey team logged comments from survey participants regarding their opinion of messages they liked or recommended, and their general opinions of DMS, as presented in Appendix B.

SITE DESCRIPTIONS

Kansas

Surveys were conducted on the I-70 corridor in Kansas from July 6-9 and September 8-11 in 2015. Figure 3 is a map of the DMS locations along the I-70 study corridor in Kansas between Salina and Topeka, and the survey intercept locations, three at rest areas and one at an off-interstate location, a Petro Travel Center. Specifically, surveys were conducted at the westbound rest area near milepost 308 on July 6 in the afternoon and all day on July 7. On July 8, surveys were conducted at the eastbound rest area on the west end of the corridor in the morning and at the Petro Travel Center in Salina that afternoon. Surveys were conducted at the eastbound rest area near Paxico on the east end of the corridor on July 9 and all dates in September.

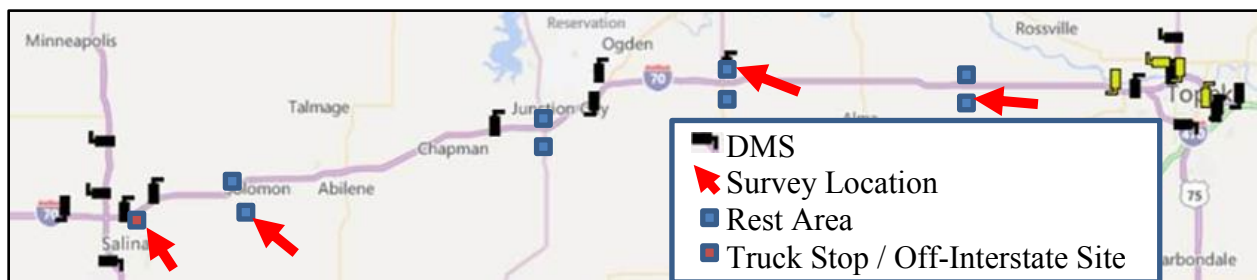


Figure 3. Map. DMS Locations on the I-70 Study Corridor.

Minnesota/Wisconsin

Surveys were conducted on the I-94 corridor in Minnesota and Wisconsin from May 26-28, September 15-17, and October 26-29 in 2015. Note that the I-94 study corridor is split between Minnesota and Wisconsin. The locations of the three Minnesota DOT-operated DMS in the I-94 study corridor are shown in Figure 4, along with the survey intercept location at the westbound Minnesota Welcome Center rest area. This location was used for most survey days in the corridor, given the higher survey participation rates, and evidence that travelers had also observed the DMS on the I-94 corridor through Wisconsin.

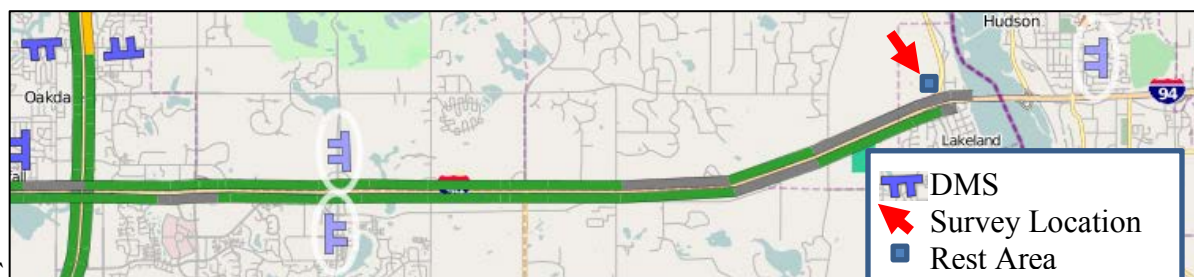


Figure 4. Map. Three Minnesota DOT DMS locations on the I-94 Minnesota Study Corridor, including one Located in Wisconsin.

Figure 5 shows the ten current DMS locations on the I-94 study corridor in Wisconsin, and two survey intercept locations that were used on a single survey day, including a gas station at an off-interstate location in Osseo, Wisconsin and the eastbound Black River Falls rest area.

Note that for this survey corridor during the May 26-28 survey dates, an additional two questions about the use of portable changeable message signs (PCMS) to display safety messages were added to the survey at the request of Wisconsin DOT. In conjunction with this request, the Wisconsin DOT placed additional PCMS in the field that displayed an abbreviated version of the safety message being displayed on the permanent DMS.

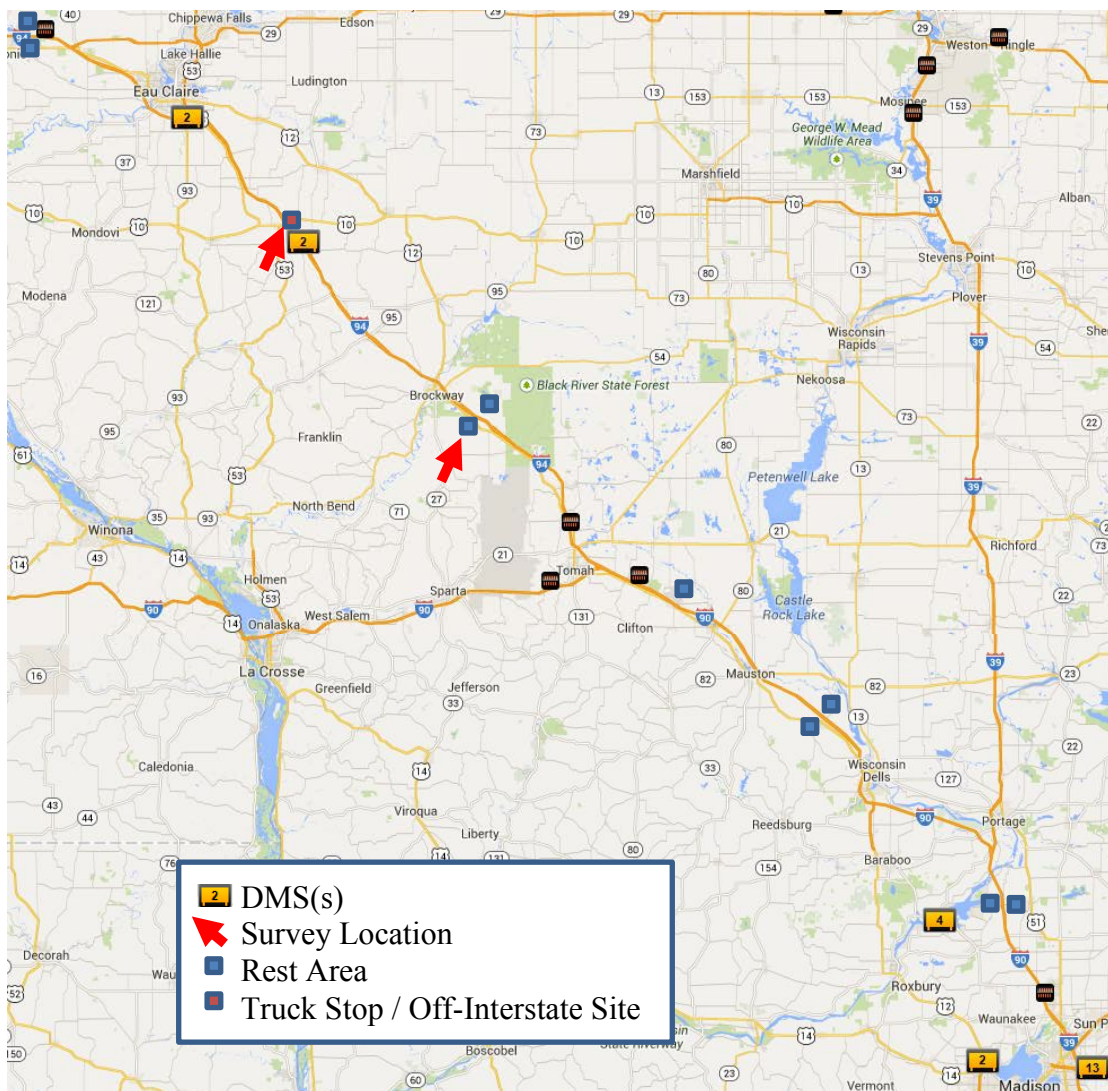


Figure 5. Map. Current DMS Locations on the I-94 Wisconsin Study Corridor from Madison (bottom right) Northwest through Eau Claire (top left).

Missouri

Surveys were conducted on the I-44 corridor in Missouri from July 13-15, October 14-15, and November 2-5 in 2015. DMS on the I-44 study corridor are shown in Figure 6, and the survey intercept locations at the eastbound and westbound St. Clair rest areas. This corridor was particularly rural with few, if any, off-interstate locations that had significant traffic volumes. The survey team therefore conducted surveys only in the rest area locations, which had relatively high volumes because there are few rest area locations along the corridor.

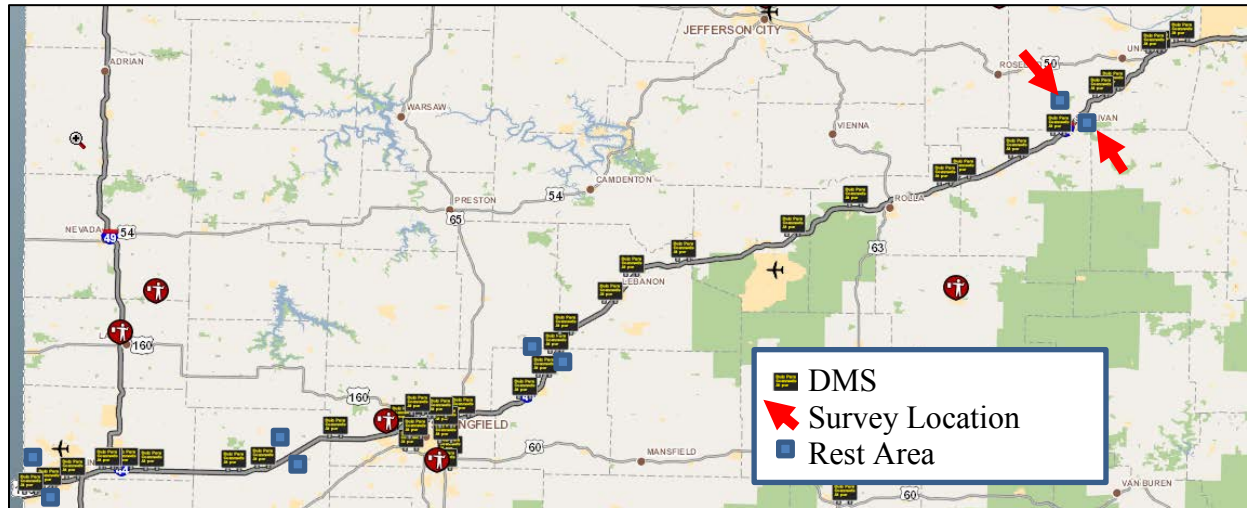


Figure 6. Map. DMS Locations on the I-44 Study Corridor.

Nevada

Surveys were conducted on the I-80 corridor near Fernley, Nevada from May 4-7 and October 5-7 in 2015. Figure 7 below shows the DMS locations in the I-80 study corridor, and the two survey intercept locations near Fernley, Nevada. The westbound Wadsworth Rest Area near Fernley was located immediately downstream of a DMS that was positioned in the median, and surveys were conducted here for most days. Surveys were also conducted one day at the Fernley Pilot Travel Center to increase survey participation from truckers. Alternative locations were considered elsewhere on the western portion of the corridor, but ultimately dismissed. Specifically, both a second off-interstate gas station location near Lovelock and the Trinity Rest Area at US 95 had minimal traffic. Rest areas near Winnemucca were considered as potential survey locations, however for unknown reasons the DMS were not displaying the safety messages as scheduled.

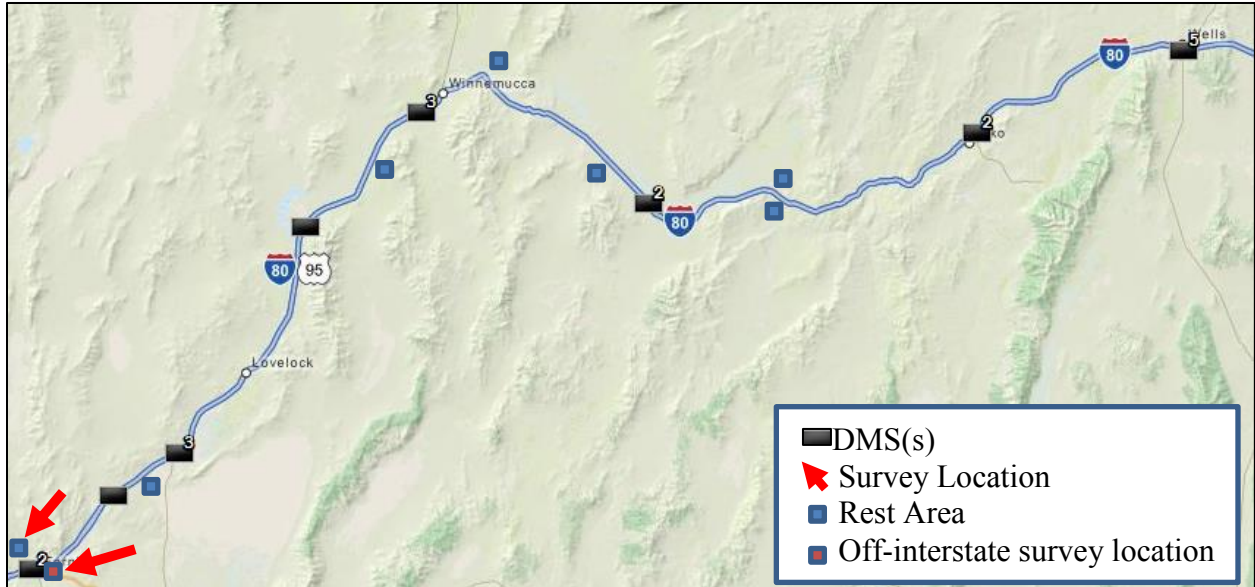


Figure 7. Map. DMS Locations on the I-80 Study Corridor.

CHAPTER 4. ANALYSIS METHODOLOGY

The statistical analysis of the information collected from travelers as part of this test was performed using SASTM statistical analysis software. For each question in the questionnaire, means and standard deviations (for continuous responses) or contingency tables (for categorical responses) were prepared. In addition, graphical summaries (histograms, mean and confidence interval plots, etc.) were prepared for select questions. Statistical procedures were used to create confidence intervals and to compare responses for a particular question. Wherever possible, appropriate population weighting was applied to group statistics.

Comparisons between groups of respondents, such as between the four study corridors, were completed using Analysis of Variance (ANOVA) techniques that included as explanatory factors traveler demographics, traffic conditions, time of day/day of week, etc. The inclusion of these other factors and the use of a general linear modeling approach facilitated the ability to detect significant differences after accounting for different sources of variation when compared to simple t-tests or categorical frequency table analysis. Survey weighting procedures were utilized in the models whenever possible.

CHAPTER 5. FINDINGS AND RECOMMENDATIONS

This section summarizes the analysis findings for each hypothesis, provides the conclusions from the evaluation, and present recommendations for displaying public service announcements (PSAs) and safety messages on dynamic message signs (DMS) in rural areas, as well as future research needs or recommendations for changes in key reference documents.

STUDY FINDINGS

Safety Campaign Messages Posted During this Study

The displayed information type changed by site and round (R1, R2, R3) as shown in Table 3. Seatbelt-related messages were the most common message campaign theme for the four sites during the data collection period, followed by general safety information. Note that only catchy messages were shown for the duration of survey activities in Missouri. As such, this presents an opportunity to examine the possible impacts of catchy versus traditional messages on DMS. However, it is important to keep in mind a variety of factors that could cause bias, including geographic differences, site characteristics, the relative proximity of the DMS to the survey, and the safety campaign or PSA type being displayed.

Table 3. Safety Campaign Messages Posted During this Study.

State, Corridor	Survey Round, 2015 Dates	Safety Campaign Message Content*	Information Type
Nevada, I-80	R1: 5/4-5/7; R2: 10/5-10/7	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	General Safety
		DRIVE SAFELY MAKE IT ZERO FATALITIES	General Safety
Minnesota/Wisconsin, I-94	R1: 5/26-5/28	EXTRA SEAT BELT PATROLS NOW, CLICK IT OR TICKET	Seatbelt
		BUCKLE UP, __ TRAFFIC DEATHS THIS YEAR	
	R2: 9/15-9/17; R3: 10/26-10/29	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	Mixed: Seatbelt, Distracted Driving, DUI, EMS
		BUCKLE UP, __ TRAFFIC DEATHS THIS YEAR	
Kansas, I-70	R1: 7/6-7/9	MOVE OVER FOR HIGHWAY WORKERS	Work zone/ EMS
		MOVE OVER FOR EMERGENCY VEHICLES	
Kansas, I-70	R2: 9/8-9/11	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	DUI and EMS
		MOVE OVER FOR EMERGENCY VEHICLES	
Missouri**, I-44	R1: 7/13-7/15	It's a Passing Lane...Not a Cruising Lane	Safe driving and Seatbelt
		Pass on Left, Drive on Right	
		Changing Lanes? Show Me Your Blinker	
		Turn Signals...The Original Instant Message	
		Unbuckled? Seriously?	
	R2: 10/14-10/15	It's No Trick, Seatbelts Are a Treat	Seatbelt
		Buckle Up, Have a Nice Day	
		That Seat Belt Looks Good On You	
	R3: 11/2-11/5	All Buckled, All Seats, All the Time	Seatbelt
		That Seat Belt Looks Good On You	
		Buckle Up, Windshields Hurt	
		Give Thanks, Buckle Up, Drive Safely	
		Thanks for Wearing Your Seat Belt	
Thanks for Buckling Kids in Car Seats			

** Messages that were asked to be interpreted during surveys are shown in bold.*

*** Missouri posts PSAs and safety messages in Title Case, and not ALL CAPS.*

Traveler Type Distribution

Table 4 presents the number of travelers encountered during each round of surveying at each location, and whether they took the survey or their reason for not participating. It should be noted that the information presented in the table hints at valuable, but imperfect information. There are a number of reasons for people to refuse to take the survey, and it is possible that travelers say they did not see a DMS just to avoid further engagement with the survey team. In other instances, travelers verbally expressed frustration that they had not seen the DMS, which could be the result of several factors. The DMS in Kansas, Missouri, and Wisconsin are typically placed by the side of the road, the DMS in Nevada were either overhead or in the median, and the DMS in Minnesota were overhead, and a traveler passing or closely following a truck may not see the DMS, for example. In other cases, the survey intercept location may have been further away from the DMS and therefore less memorable to travelers. While distracted driving is an issue and there is an interest in understanding whether signs are not visible to travelers or a distraction that travelers ignore, for example, the focus of this survey effort was to capture feedback based on direct recall of recently seeing the message. As with any similar survey effort, unpleasant weather or a location with busy travelers can cause reduced survey participation, which may vary by corridor or day.

Table 4. Number of Travelers Encountered.

State, Survey Round		Screener Results (Did not take survey)					Subtotal	Survey Responses	Total Travelers
		Refused before determining eligibility	Eligible and Refused	Ineligible (did not see DMS)	Ineligible (did not travel on corridor)	Other barrier, e.g., language			
NV	R1	153	68	84	26	14	345	204	549
	R2	23	49	40	2	11	125	93	218
MN/WI	R1	141	91	188	7	3	430	160	590
	R2	53	64	62	0	15	194	233	427
	R3	352	196	67	1	5	621	289	910
KS	R1	80	125	115	0	5	325	177	502
	R2	30	54	31	7	6	128	216	344
MO	R1	141	101	70	0	10	322	181	503
	R2	34	59	35	3	7	138	102	240
	R3	304	247	200	0	22	773	282	1055
Total		1311	1054	892	46	98	3401	1937	5338

Table 5 and the corresponding Figure 8 summarize survey participants by group for each site. Infrequent travelers comprised the highest percentage of survey participants in Kansas, Missouri, and Nevada. Surveys on these corridors were conducted at rest areas, as these locations seemed to provide the highest volume of travelers to intercept who had actually been on the corridor to see a DMS. Frequent travelers often consist of individuals whose origin and destination are not

necessarily directly off of the highway and not far enough apart to merit an en route stop near the highway. Truckers consist of a lower percentage of travelers on each corridor as a whole.

Table 5. Number of Survey Participants per Corridor, and Percentage by Traveler Type.

State	Corridor	Number of Survey Participants			
		Infrequent	Frequent	Truckers	Total
Nevada	I-80	122	84	91	297
		41%	28%	31%	100%
Minnesota/ Wisconsin	I-94	225	272	185	682
		33%	40%	27%	100%
Kansas	I-70	195	113	85	393
		50%	29%	22%	100%
Missouri	I-44	285	112	168	565
		50%	20%	30%	100%
OVERALL		827	581	529	1937
		43%	30%	27%	100%

Note: percentages may not sum to 100 exactly due to rounding.

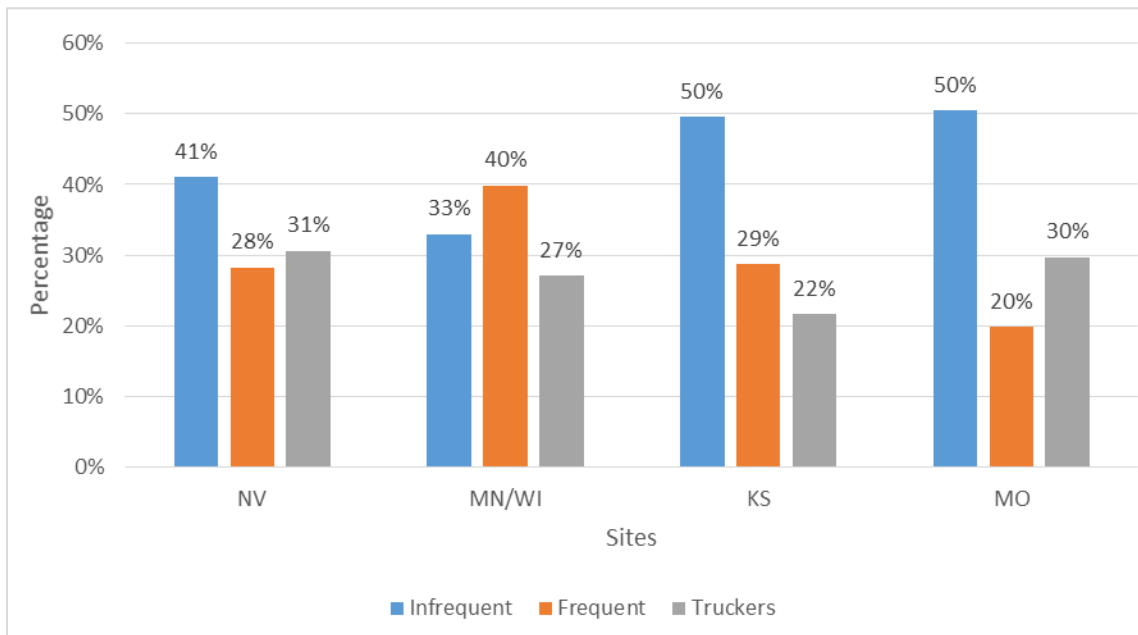


Figure 8. Graph. Percentage of Each Traveler Type by Site.

Gender Distribution

Table 6 and Figure 9 summarize the gender distribution among participants. In all four sites there were significantly more male participants (around 70 percent) than female participants. Anecdotally, this appeared to be reflective of the driving population encountered by the survey team. The proportions of male and female travelers intercepted for each location generally reflect the percentages of survey participants.

Table 6. Number of Survey Participants per Corridor, and Percentage by Gender.

State	Corridor	Number of Survey Participants		
		Female	Male	Total
Nevada	I-80	85	212	297
		29%	71%	100%
Minnesota/ Wisconsin	I-94	185	497	682
		27%	73%	100%
Kansas	I-70	129	264	393
		33%	67%	100%
Missouri	I-44	176	389	565
		31%	69%	100%
OVERALL		575	1362	1937
		30%	70%	100%

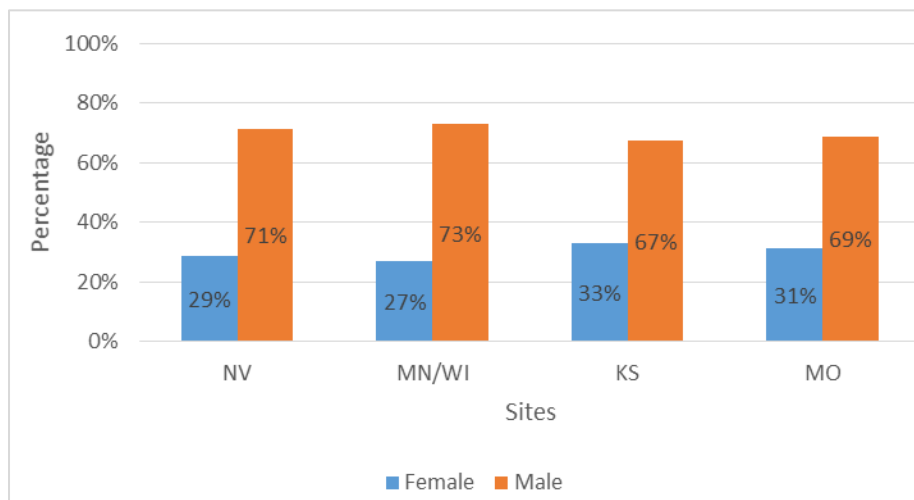


Figure 9. Graph. Percentage of Gender in Each Site.

Frequency of Seeing General Safety Campaign Messages on DMS

Table 7 and Figure 10 provide the panel composition based on frequency of seeing the safety campaign messages on DMS. Kansas, Missouri, and Nevada survey participants had a very similar distribution in terms of self-reported frequency of seeing safety campaign messages on DMS. In those sites, the highest percentage (around 37 percent) of travelers see safety campaign message on DMS less than one time per month, with the second highest (around 27 percent) at 1-3 times per month. In Minnesota/Wisconsin, the participant groups were roughly switched with the largest group (around 34 percent) being travelers who reported seeing safety campaign message 1-3 times per month, followed by 26 percent of travelers who reported a frequency of less than one time per month. The switch in Minnesota/Wisconsin may reflect the slightly higher proportion of frequent travelers versus infrequent travelers, and the proximity to the Minneapolis-St. Paul metro area where DMS are common.

Table 7. Number of Survey Participants per Corridor, and Percentage by Frequency of Seeing Safety Campaign Messages on DMS.

State	Corridor	Number and Percentage of Survey Participants				
		<1 time per month	1-3 times per month	1-3 times per week	>3 times per week	Total ¹
Nevada	I-80	108	83	38	67	296
		36%	28%	13%	23%	100%
Minnesota/ Wisconsin	I-94	175	232	104	170	681
		26%	34%	15%	25%	100%
Kansas	I-70	145	106	56	85	392
		37%	27%	14%	22%	100%
Missouri	I-44	215	147	76	126	564
		38%	26%	13%	22%	100%
OVERALL		643	568	274	448	1933
		33%	29%	14%	23%	100%

¹ *Four participants did not provide inputs.*

Note: percentages may not sum to 100 exactly due to rounding.

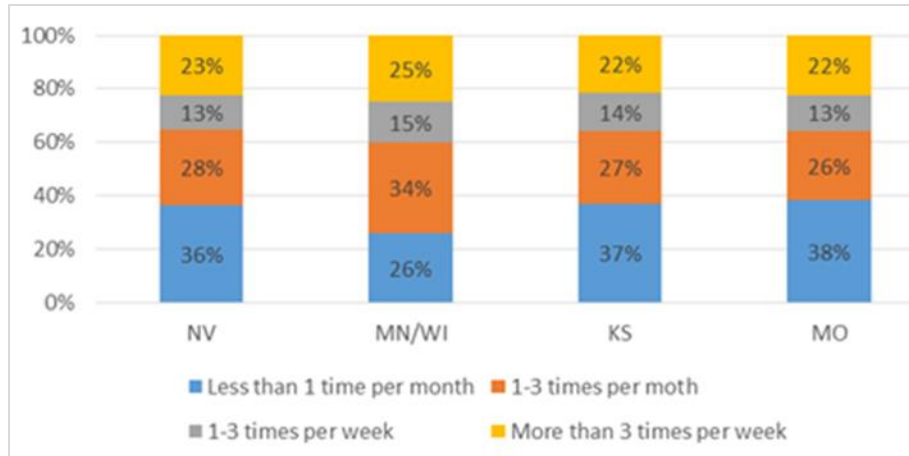


Figure 10. Graph. Frequency of Seeing Safety Campaign Messages on DMS.

HYPOTHESES AREA AND SURVEY QUESTIONS

Table 8 lists the evaluation hypotheses and the related survey questions that were utilized to evaluate the hypotheses.

For each of the hypotheses, the following results begin with a simple summary of responses by site. Following that simple summary, a statistical ANOVA model has been fit to the responses for each question. That model compares the responses under several groupings:

- a) Traveler type (i.e., infrequent, frequent, truckers).
- b) Age (i.e., 16-55, over 55).
- c) Gender.
- d) Round (i.e., survey responses were evaluated over 2 or 3 rounds of data collection).
- e) Frequency of seeing DMS messages (i.e., <1 time per month, 1-3 times per month, 1-3 times per week, >3 times per week).

The responses to the survey questions are in the form of percentages. Each survey question either naturally yields a dichotomous response, or has been transformed into one (e.g., scaled response of “Agree” and “Strongly Agree” are added together to generate a single response for “Agree”). When the dichotomous response is fit to the logistic regression statistical model, the estimates for the variables of interest compared between levels are provided as odds ratios. The odds ratio is the probability of being in a class divided by probability of not being in the class for one condition divided by the odds of the comparison condition. The reported odds ratios are accompanied by statistical 95 percent confidence intervals. If estimated odds ratios exceed 1.0, it means the odds of the condition are higher for the comparison group. The converse is true for odds ratios less than 1.0. If the 95 percent confidence interval is either wholly above 1.0 or wholly below 1.0, it provides evidence that the survey data collected identify the difference as significant. The interpretation of the significance is that the data collected provide a probability of no more than one chance in 20 that the difference was due to random chance. Instead, it is highly likely the direction of the observed outcome reflects truth.

For most questions, the statistical models were fit separately for each site. For a few hypotheses, sites were combined.

Table 8. Hypothesis Areas and Survey Questions.

Evaluation Area	Hypotheses	Evaluation Questions
Awareness	A significant percentage of travelers have observed an actual safety message and/or PSA on a DMS	Did you observe one of these safety-related messages on DMS?
Understanding	Drivers can understand the messages on the DMS	What does “*specific message*” mean to you? Do you agree that “*” is understandable?
Behavior Changes	The display of a PSA on a DMS does not cause traffic to slow down or other congestion	Have these messages ever caused you to slow down?
	The contents of the PSA cause a change in behavior by the travelers (e.g., more aware, looking for an AMBER alert license plate, etc.)	After seeing the messages did you do anything differently? Has seeing one of these messages ever caused you to change your driving?
Opinions	Travelers believe that DMS for safety awareness and PSA messages are appropriate	Do you agree that the message is appropriate?
	Travelers believe that DMS should only be used for traffic-related messages	What types of message do you think should be displayed on DMS?
	Travelers believe that it would be more effective and/or less distracting to motorists to disseminate safety awareness messages and PSAs via other means	Which way of communicating safety-related information do you think is best?
	Travelers perceive a value of safety awareness and PSA messages on DMS	Do you agree that the message raised your awareness of the issue?

EVALUATION OF AWARENESS

- Hypothesis: A significant percentage of travelers have observed an actual safety message and/or PSA on a DMS.
 - Question: Did you observe one of these safety-related messages on DMS?

Because all survey participants already said they had seen a DMS in order to be eligible to take the survey, the number of travelers encountered by survey administrators, presented in Table 4, provide some insight for this hypothesis. In total for all survey rounds, 2991 travelers (77 percent, this number includes the 1937 survey participants and 1054 travelers who were eligible but refused to take the survey), responded that they had seen the DMS, compared with 892 travelers who had not.

Did you observe one of these safety-related messages on the DMS?

Participants were permitted to select from a list of safety campaign messages that were truly posted, as well as a false message (i.e., “smoking is harmful to your health”). They also were permitted to respond that they had not seen any message. The survey allowed any combination of responses. In summarizing the responses, five mutually exclusive categories were identified. There were some participants whose responses were coded as “invalid”, as they selected an illogical option (i.e., selecting “None” and one or more messages at the same time). These data were removed from the modelling dataset, but are included in the Table 5 summary.

From Table 9 and Figure 11, it can be seen that a majority of the participants, between 60 to 89 percent, observed at least one of the specified safety-related messages on DMS, indicating a high awareness level of the posted safety-related messages. Compared with other sites, Missouri appears to have the lowest percentage of participants reporting that they observed at least one of the messages, and the highest percentage of participants who did not see any of the listed messages in the survey. This could be due to several factors, including the fact that a greater number of messages were shown during the survey periods and DMS were further upstream from the survey location in Missouri than at other corridors. Missouri is also the only site where catchy messages were displayed on the DMS.

Table 9. Number of Survey Participants per Corridor, and Percentage on Whether They See Identified Safety Campaign Messages on DMS.

State	Round	Number and Percentage of Survey Participants					
		At Least One True	False Message	True & False	None	Invalid	Number of Participants
Nevada	R1	71%	2%	11%	15%	1%	204
	R2	81%	1%	12%	1%	5%	93
Minnesota/ Wisconsin	R1	88%	0%	9%	2%	1%	160
	R2	85%	0%	13%	1%	2%	233
	R3	86%	0%	9%	5%	0%	289
Kansas	R1	89%	1%	5%	5%	2%	177
	R2	79%	0%	19%	1%	1%	216
Missouri	R1	77%	1%	5%	17%	1%	181
	R2	60%	3%	10%	24%	4%	102
	R3	70%	1%	12%	17%	1%	282
All Participants		1529 (79%)	12 (1%)	206 (11%)	163 (8%)	27 (1%)	1937

Note: At least one true = the participant reported to have observed at least one of the true DMS message listed in Table 3, and not the false message (“smoking is harmful to your health”).

False message = only the false message (“smoking is harmful to your health”) was chosen by the participant.

True & False = the participant chose both the false message and one or more of the true messages.

None = the participant indicated that they did not observe any of the messages listed in the question.

Invalid = the participant chose both “None” and one or more of the listed messages. Percentages may not sum to 100 exactly due to rounding.

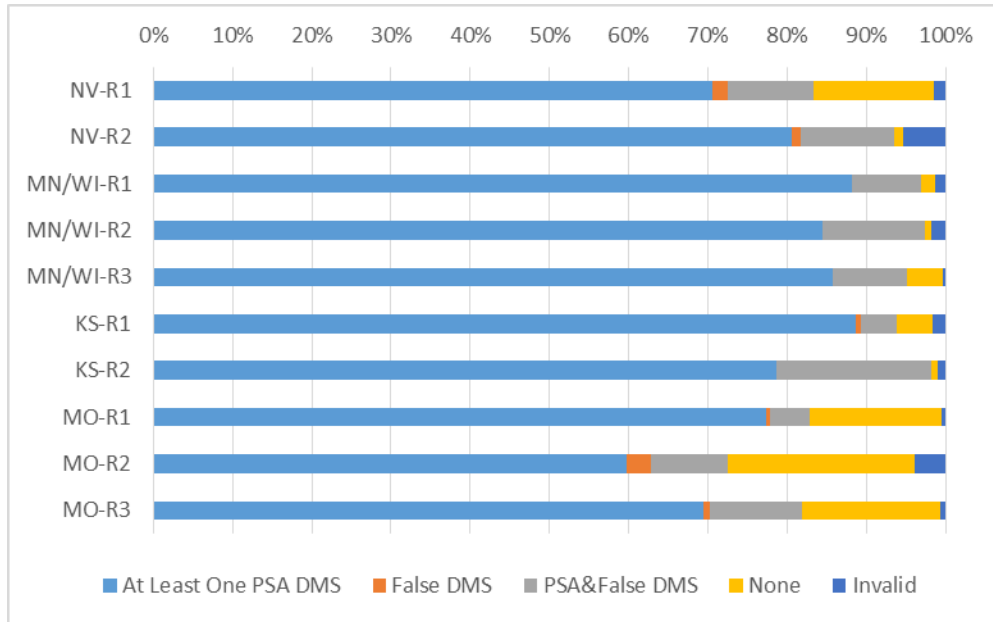


Figure 11. Graph. Percentage of Respondents that Reported Seeing the Posted Safety-Related Messages on DMS.

For modeling purposes, participant responses were grouped into two categories. The first category was participants who observed at least one (true) safety-related message, while other types of responses were aggregated as the second category. A binary logistic regression model was fit with traveler type, age, gender, round, and frequency of seeing a safety-related message during general travels as the predictors. The modeled probability was of observing at least one of the (true) listed safety-related messages.

Table 10 below and Figure C-1 through Figure C-4 in Appendix C show the estimated odds ratios and confidence intervals from the model. Infrequent travelers had higher levels of awareness in Kansas, Minnesota/Wisconsin, and Nevada followed by frequent travelers, while truckers had the lowest awareness level. However, the differences were not statistically significant in either Kansas or Minnesota/Wisconsin; infrequent travelers reported statistically significantly higher awareness level than truckers in Nevada. Anecdotally, truckers commented more than other travelers that DMS messages were a waste of money or not relevant to them. Missouri had a different pattern, with infrequent travelers having significantly lower awareness level than frequent travelers. This could be the result of the relatively longer distance of the DMS from the survey location and fewer rural DMS located upstream of the Missouri survey location than in other corridors.

Younger travelers tended to report a higher awareness of the listed safety-related message for all four sites. However, only in Minnesota/Wisconsin was a statistically significant difference found.

The impact of gender varied, but was found to be significant in Nevada, where females were found to be significantly less aware of the listed safety-related message than males.

Survey date/round had significant impacts for all sites other than Minnesota/Wisconsin for unknown reasons, but the direction of the conclusion varied. Response levels did not appear to be impacted significantly as a function of how often DMS signs were reported to be seen.

Table 10. Odds Ratios and 95 Percent Confidence Limits – Awareness Hypothesis of Observing an Actual Safety Message and/or PSA on a DMS by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	1.5 (0.7, 3.3)	1.1 (0.6, 2.1)	1.3 (0.6, 2.6)	0.5 (0.3, 0.9)
TravelerType 1 vs 3	2.6 (1.1, 6.2)	1.5 (0.7, 3.0)	2.2 (0.9, 5.0)	0.7 (0.4, 1.1)
TravelerType 2 vs 3	1.8 (0.8, 3.8)	1.3 (0.7, 2.4)	1.7 (0.9, 4.0)	1.4 (0.7, 2.6)
Age 1 vs 2	1.5 (0.8, 2.8)	2.5 (1.5, 4.2)	1.8 (1.0, 3.4)	1.3 (0.9, 2.0)
Gender Female vs Male	0.5 (0.3, 1.0)	1.7 (1.0, 3.0)	1.2 (0.6, 2.2)	0.9 (0.6, 1.4)
Round R1 vs R2	0.4 (0.2, 0.9)	1.2 (0.6, 2.3)	2.9 (1.5, 5.4)	2.0 (1.1, 3.5)
Round R1 vs R3		1.2 (0.6, 2.2)		1.5 (0.9, 2.3)
Round R2 vs R3		1.0 (0.6, 1.7)		0.7 (0.5, 1.2)
DMSFrequency 1 vs 2	0.7 (0.3, 1.7)	0.9 (0.5, 1.7)	1.4 (0.7, 3.0)	0.8 (0.5, 1.3)
DMSFrequency 1 vs 3	0.6 (0.3, 1.3)	0.8 (0.4, 1.6)	0.9 (0.4, 1.9)	0.8 (0.5, 1.4)
DMSFrequency 2 vs 3	0.8 (0.4, 1.6)	0.9 (0.5, 1.7)	0.7 (0.3, 1.3)	1.1 (0.6, 1.8)

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week.

Value in bold means that the odds ratio is significantly different than 1.

EVALUATION OF UNDERSTANDING

- Hypothesis: Drivers can understand the messages on the DMS.
 - Question: What does “*specific message*” mean to you?
 - Question: Do you agree that “*” is understandable?

What does the identified message mean to you?

Survey participants were asked to select from multiple choice options to determine if they understood the meaning of one of the safety messages currently being displayed in the corridor. For each site and survey round, different message were selected for the participant to interpret. As shown in Table 11, most travelers correctly interpreted the messages posted during each survey round for each corridor. Minnesota/Wisconsin Round #1 had the highest correct interpretation rate at 95 percent when asked to correctly interpret “Click it or ticket.” However, Minnesota/Wisconsin also had the lowest correct interpretation rate (58 percent) at Round 2 when asked to correctly interpret, “WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES.”

Table 11. Number of Survey Participants per Corridor, and Percentage on the Understanding of the Listed Message.

State	Round	Number and Percentage of Survey Participants			
		Incorrect	Correct	No Data	Total
Nevada	R1	6%	93%	1%	204
	R2	6%	92%	1%	93
Minnesota/ Wisconsin	R1	4%	95%	1%	160
	R2	42%	58%	0%	233
	R3	34%	65%	0%	289
Kansas	R1	22%	76%	2%	177
	R2	35%	65%	0%	216
Missouri	R1	11%	88%	1%	181
	R2	16%	84%	0%	102
	R3	8%	91%	0%	282
All Participants		396 (20%)	1528 (79%)	13 (1%)	1937

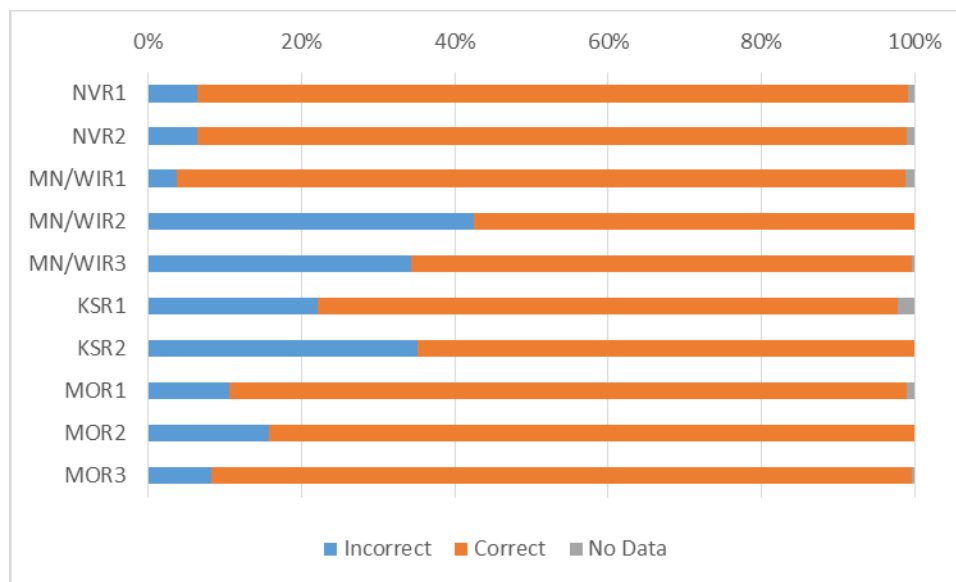


Figure 12. Graph. Safety-Related Message Interpretation by Site.

A binary logistic model was fit to the data with the probability of understanding the identified message correctly as the response and traveler type, age, gender, round, and frequency of seeing safety-related message during general travels as the predictors as shown in Table 12 and Figure C-5 through Figure C-8 in Appendix C. No statistically significant impacts were found in either Kansas or Minnesota/Wisconsin corridors. In Nevada, truckers were found to have a significantly lower understanding level than both infrequent travelers and frequent travelers. In Missouri, infrequent travelers' understanding of the identified message was significantly lower

than frequent travelers. This may be a result of frequent drivers being more familiar with the catchy messages posted in Missouri.

Only in Minnesota/Wisconsin was a statistically significant impact of age observed where younger travelers understood the identified message better. Females were found to understand the identified message significantly better than male travelers in Missouri and Nevada.

An interesting finding is that the traveler frequency of seeing safety-related messages on DMS was positively correlated with their understanding of the identified message in each site.

Table 12. Odds Ratios and 95 Percent Confidence Limits – Understanding Hypothesis on Understanding of the Listed Message by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	0.8 (0.2, 2.9)	0.8 (0.6, 1.1)	1.0 (0.6, 1.4)	0.5 (0.2, 0.9)
TravelerType 1 vs 3	4.5 (1.7, 11.9)	0.8 (0.6, 1.2)	1.0 (0.6, 1.6)	0.7 (0.4, 1.3)
TravelerType 2 vs 3	5.4 (1.7, 17.0)	1.0 (0.7, 1.4)	1.1 (0.6, 1.7)	1.6 (0.8, 3.1)
Age 1 vs 2	1.2 (0.6, 2.5)	1.5 (1.2, 2.0)	1.3 (0.9, 1.8)	0.8 (0.6, 1.3)
Gender Female vs Male	5.9 (1.3, 25.8)	1.0 (0.7, 1.3)	1.2 (0.9, 1.7)	2.6 (1.5, 4.3)
Round R1 vs R2	0.9 (0.4, 2.0)	19.2 (10.4, 35.4)	1.9 (1.4, 2.6)	1.4 (0.9, 2.4)
Round R1 vs R3		13.8 (7.5, 25.4)		0.7 (0.5, 1.1)
Round R2 vs R3		0.7 (0.6, 0.9)		0.5 (0.3, 0.8)
DMSFrequency 1 vs 2	0.4 (0.1, 0.9)	0.7 (0.5, 0.9)	0.6 (0.4, 1.0)	0.5 (0.3, 0.9)
DMSFrequency 1 vs 3	0.2 (0.1, 0.6)	0.8 (0.5, 1.1)	0.6 (0.4, 0.9)	0.5 (0.3, 0.9)
DMSFrequency 2 vs 3	0.6 (0.2, 1.5)	1.2 (0.8, 1.6)	0.9 (0.6, 1.4)	1.0 (0.6, 1.9)
<i>R1 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	CLICK IT OR TICKET	MOVE OVER FOR HIGHWAY WORKERS	It's a Passing Lane...Not a Cruising Lane
<i>R2 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	It's No Trick, Seatbelts Are a Treat
<i>R3 Specified Message</i>		WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES		All Buckled, All Seats, All the Time

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week. Value in bold means that the odds ratio is significantly different than 1.

Do you agree that the identified message is understandable?

Site by Site

Participants were asked their agreement on whether the identified safety message currently being displayed on the corridor was understandable. Note that the messages presented for this question for each survey round were the same messages as the previous Understanding Hypotheses question. About 92 percent of travelers agreed or strongly agreed that the identified message was understandable, as shown in Table 13 and Figure 13. Missouri had a relatively lower percentage of travelers who agreed or strongly agreed with the statement. When participant responses to this question were compared with those in the previous question (interpretation of the identified DMS), it was found that although a very high percentage of participants considered the identified DMS understandable, a relatively smaller percentage of participants interpreted the message correctly.

Table 13. Number of Survey Participants per Corridor, and Percentage on Their Agreement on Whether the Message is Understandable.

State	Round	Number and Percentage of Survey Participants					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Nevada	R1	3%	1%	4%	17%	75%	201
	R2	2%	0%	1%	42%	54%	92
Minnesota/ Wisconsin	R1	3%	1%	2%	27%	67%	158
	R2	3%	0%	3%	35%	59%	233
	R3	3%	1%	3%	29%	64%	286
Kansas	R1	5%	1%	3%	29%	62%	170
	R2	5%	1%	1%	21%	71%	216
Missouri	R1	4%	0%	4%	33%	58%	178
	R2	3%	1%	8%	40%	48%	102
	R3	4%	3%	6%	34%	53%	280
All Participants		68 (3%)	22 (1%)	71 (4%)	570 (30%)	1185 (62%)	1916

Note: 21 participants did not provide inputs.

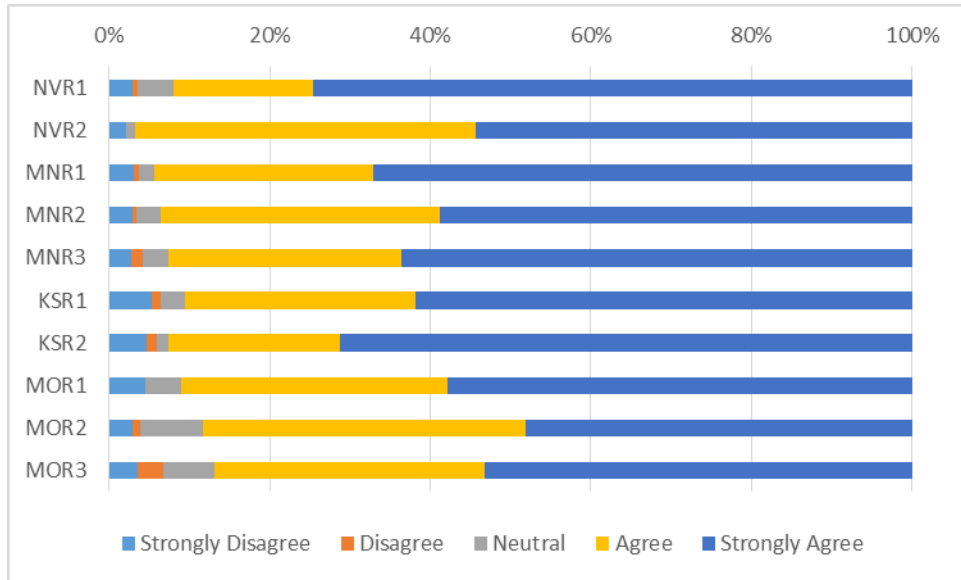


Figure 13. Graph. Responses to “Do You Agree that the Identified DMS was Understandable?” by Survey Round.

A binary logistic model was fit to the data with the probability of travelers agreeing or strongly agreeing that the message was understandable as the response and traveler type, age, gender, round, and frequency of seeing safety-related message during general travels as the predictors, as shown in Table 14 and Figure C-9 through Figure C-12 in Appendix C. In both Kansas and Nevada, infrequent travelers were more likely than frequent travelers or truckers to consider the message as understandable.

Table 14. Odds Ratios and 95 Percent Confidence Limits - Understanding Hypothesis on Whether the Message is Understandable by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	2.6 (0.9, 7.3)	1.1 (0.6, 2.0)	2.3 (1.2, 4.5)	1.0 (0.6, 1.7)
TravelerType 1 vs 3	4.6 (1.4, 14.9)	0.8 (0.4, 1.5)	1.3 (0.6, 2.7)	0.8 (0.5, 1.3)
TravelerType 2 vs 3	1.8 (0.8, 4.3)	0.7 (0.4, 1.2)	0.6 (0.3, 1.1)	0.8 (0.5, 1.4)
Age 1 vs 2	5.5 (2.3, 13.1)	0.4 (0.2, 0.6)	0.4 (0.2, 0.7)	0.6 (0.4, 0.9)
Gender Female vs Male	0.4 (0.2, 0.9)	2.0 (1.1, 3.6)	2.0 (1.0, 4.0)	1.0 (0.7, 1.5)
Round R1 vs R2	0.4 (0.2, 1.0)	1.3 (0.7, 2.3)	0.8 (0.5, 1.4)	1.4 (0.8, 2.5)
Round R1 vs R3		1.2 (0.6, 2.1)		1.6 (1.0, 2.5)
Round R2 vs R3		0.9 (0.6, 1.5)		1.1 (0.7, 1.9)
DMSFrequency 1 vs 2	0.8 (0.3, 2.4)	0.7 (0.4, 1.4)	0.8 (0.4, 1.7)	0.8 (0.5, 1.2)
DMSFrequency 1 vs 3	1.1 (0.4, 3.1)	0.8 (0.4, 1.5)	1.1 (0.6, 2.3)	0.6 (0.3, 0.9)
DMSFrequency 2 vs 3	1.3 (0.6, 3.1)	1.1 (0.6, 1.9)	1.4 (0.7, 2.8)	0.7 (0.4, 1.2)
R1 Specified Message	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	CLICK IT OR TICKET	MOVE OVER FOR HIGHWAY WORKERS	It's a Passing Lane...Not a Cruising Lane
R2 Specified Message	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	It's No Trick, Seatbelts Are a Treat
R3 Specified Message		WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES		All Buckled, All Seats, All the Time

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week. Value in bold means that the odds ratio is significantly different than 1.

Messages at All Sites

Survey respondents were presented a series of PSA messages that had been displayed in other survey corridors (e.g., Kansas respondents saw PSA messages that had been displayed in Minnesota/Wisconsin and Nevada), as well as a weather message. Findings show that over 96 percent of all respondents found all four of the messages to be understandable. Participant responses in Figure 14 are presented so that they can be matched in the same category across sites. Note for Figure 14 that invalid means that conflicting responses were selected (i.e., selected both “None of these” and one of the messages); Messages from other sites means the respondent

selected at least one message displayed at the other sites; Winter Weather means the respondent selected the winter weather message only; and understand all/none of these is as stated.

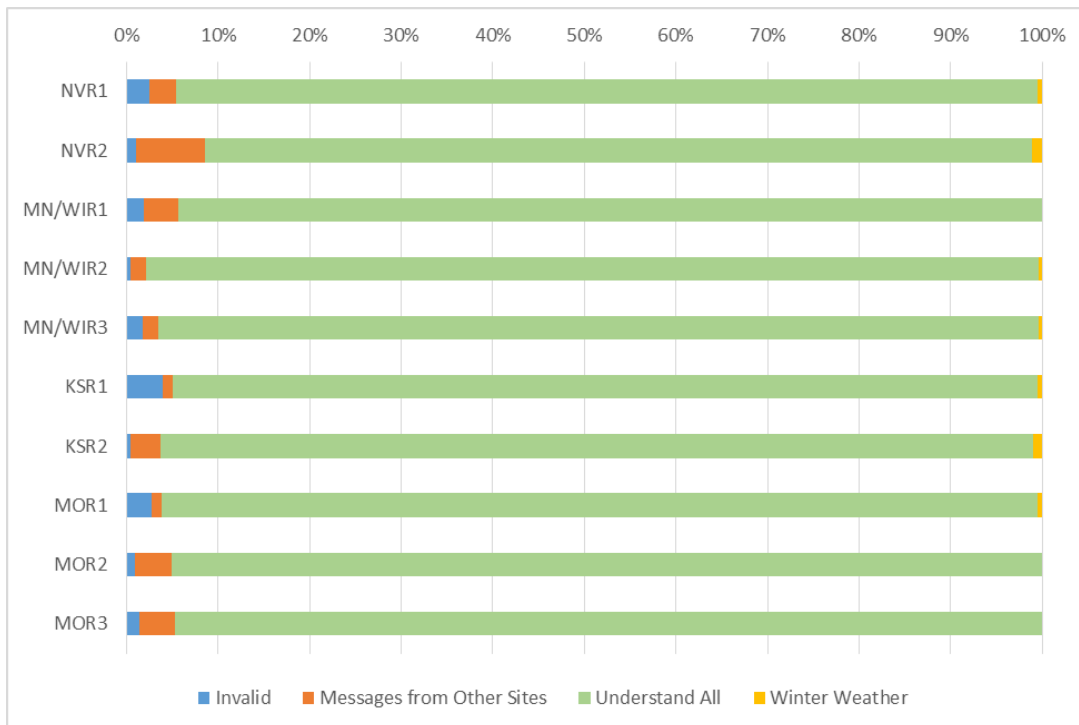


Figure 14. Graph. Respondents' Understanding of Messages Displayed at Other Sites.

EVALUATION OF BEHAVIOR CHANGE

- Hypothesis: The display of a PSA on a DMS does not cause traffic to slow down or other congestion.
 - Question: Have these messages ever caused you to slow down?
- Hypothesis: The contents of the PSA cause a change in behavior by the travelers (e.g., more aware, looking for license plates from an AMBER alert message, etc.).
 - Question: After seeing the messages did you do anything differently?
 - Question: Has seeing one of these messages ever caused you to change your driving?

General – Have these messages ever caused you to slow down?

These general questions were not related to site-specific messages. In other words, the same question was asked in all sites and during all survey rounds and no specific messages were referenced. Similar to the previous question, a smaller percentage (less than 26 percent) of travelers thought the safety-related DMS messages caused them or other travelers to slow down.

Table 15. Have these DMS ever Caused You to Slow Down?

State	Round	Number and Percentage of Survey Participants			
		Caused to Slow Down	No Change	Invalid	Number of Participants
Nevada	R1	22%	77%	0%	204
	R2	26%	72%	2%	93
Minnesota/ Wisconsin	R1	18%	83%	0%	160
	R2	14%	86%	0%	233
	R3	18%	82%	0%	289
Kansas	R1	26%	72%	2%	177
	R2	18%	82%	0%	216
Missouri	R1	21%	76%	3%	181
	R2	14%	86%	0%	102
	R3	13%	87%	0%	282
All Participants		354 (18%)	1569 (81%)	14 (1%)	1937

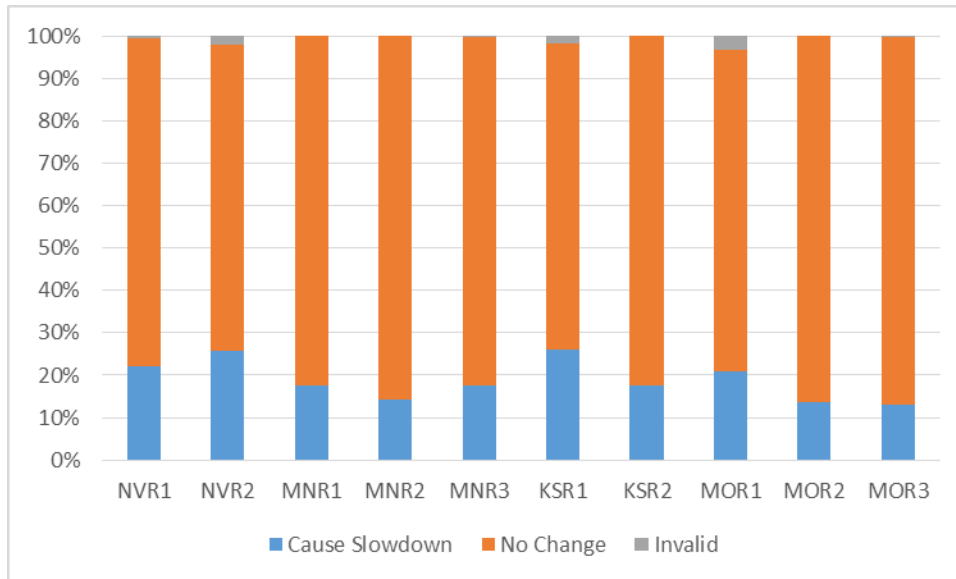


Figure 15. Graph. Participant Responses on whether Safety-Related DMS Cause Drivers to Slow Down to read the message.

A binary logistic model was fit to the data with the probability of causing them to slow down as the response and traveler type, age, gender, round, and frequency of seeing safety-related message during general travels as the predictors, as shown in Table 16 and Figure C-13 through Figure C-16 in Appendix C. In Minnesota/Wisconsin and Nevada, infrequent travelers were significantly less likely to respond that the safety-related DMS messages cause them to slow down to read the message than frequent travelers and truckers. No statistically significant differences were found in Kansas or Missouri.

In Nevada, female travelers were more likely to think the DMS messages would cause traffic to slow down. In Minnesota/Wisconsin and Missouri, travelers who observed safety-related DMS messages with lower frequency were less likely to think the DMS messages would cause them to slow down. These results may reflect geographic differences in driving behavior.

Table 16. Odds Ratios and 95 Percent Confidence Limits – Behavior Hypothesis on whether Safety-Related DMS Cause Drivers to Slow Down by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	0.7 (0.4, 1.2)	0.6 (0.4, 1.0)	0.7 (0.4, 1.0)	1.5 (1.0, 2.5)
TravelerType 1 vs 3	0.4 (0.2, 0.8)	0.5 (0.3, 0.8)	0.9 (0.5, 1.5)	1.3 (0.9, 2.1)
TravelerType 2 vs 3	0.6 (0.4, 1.0)	0.8 (0.5, 1.1)	1.3 (0.8, 2.2)	0.9 (0.6, 1.4)
Age 1 vs 2	0.7 (0.5, 1.1)	1.3 (0.9, 1.7)	1.1 (0.8, 1.6)	1.3 (0.9, 1.8)
Gender Female vs Male	1.8 (1.2, 2.9)	1.3 (0.9, 1.8)	1.0 (0.7, 1.4)	0.8 (0.5, 1.2)
Round R1 vs R2	0.8 (0.5, 1.1)	1.4 (0.9, 2.0)	1.7 (1.2, 2.4)	1.8 (1.1, 2.8)
Round R1 vs R3		1.1 (0.7, 1.5)		1.8 (1.2, 2.5)
Round R2 vs R3		0.8 (0.6, 1.1)		1.0 (0.6, 1.6)
DMSFrequency 1 vs 2	0.8 (0.5, 1.5)	0.6 (0.4, 1.0)	0.6 (0.4, 1.0)	0.4 (0.3, 0.6)
DMSFrequency 1 vs 3	0.7 (0.4, 1.3)	0.7 (0.4, 1.1)	0.7 (0.4, 1.1)	0.6 (0.4, 0.9)
DMSFrequency 2 vs 3	0.9 (0.5, 1.4)	1.1 (0.8, 1.6)	1.0 (0.7, 1.6)	1.4 (1.0, 2.1)

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week. Value in bold means that the odds ratio is significantly different than 1

After seeing the identified message did you do anything differently?

Survey participants were asked to report whether they did anything differently immediately after seeing the safety messages currently being displayed in the corridor. The analysis on this question is to understand the impact of PSAs on traveler behavior. Note, however, that changes in behavior were expected to be relatively low, given high compliance rates with the safety message, e.g., seat belt usage. As shown in Table 17 and Figure 16, 77 percent of travelers indicated that they did not do anything differently after seeing the identified message. In a follow-up question, most of these respondents said they did not change their behavior because they were already driving safely. In most surveys less than 30 percent of travelers indicated their behavior change after seeing the message, with Minnesota/Wisconsin Round 1 (“EXTRA SEAT BELT PATROLS NOW, CLICK IT OR TICKET” and “BUCKLE UP, __ TRAFFIC DEATHS THIS YEAR”) having the smallest percentage at 9 percent. Kansas Round 1 survey had the highest percentage (39%) of drivers reporting any behavior change after seeing the identified message (“MOVE OVER FOR HIGHWAY WORKERS” and “MOVE OVER FOR EMERGENCY VEHICLES”).

Table 17. Responses to “Did You Do Anything Differently?” by Site.

State	Round	Number and Percentage of Survey Participants		
		No	Yes	Number of Participants
Nevada	R1	77%	23%	204
	R2	76%	24%	93
Minnesota/ Wisconsin	R1	91%	9%	160
	R2	77%	23%	233
	R3	74%	26%	289
Kansas	R1	61%	39%	177
	R2	82%	18%	216
Missouri	R1	71%	29%	181
	R2	84%	16%	102
	R3	83%	17%	282
All Participants		1500 (77%)	437 (23%)	1937

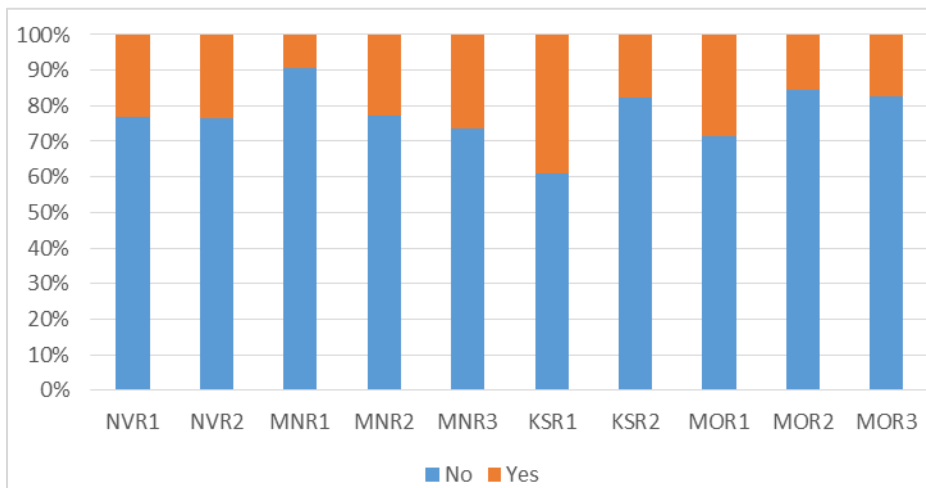


Figure 16. Graph. Responses to “Did You Do Anything Differently?” by Site.

Models were structured to investigate the probability of travelers doing things differently after seeing the identified message. It was found that infrequent travelers were significantly less likely to change their driving activity than frequent travelers and truckers in both Kansas and Nevada, as shown in Table 18 and Figure C-17 through Figure C-20 in Appendix C. However, no statistically significant differences were found in Minnesota/Wisconsin or Missouri. Younger people were more likely to do things differently than older people in Kansas and Missouri. This could reflect relatively higher traveler compliance with the subject of the safety messages being shown on certain corridors or by older drivers. Infrequent travelers on a certain corridor may also drive more and be exposed to safety messages in other areas that have helped to encourage safer driving behavior. It was found that for each site-specific model, the odds ratios were not significant only between rounds that had a same information type (i.e., seatbelt).

Table 18. Odds Ratios and 95 Percent Confidence Limits – Behavior Hypothesis on Drivers Doing Anything Differently After Seeing the Message by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	0.6 (0.4, 1.1)	0.8 (0.5, 1.1)	0.6 (0.4, 1.0)	1.0 (0.6, 1.5)
TravelerType 1 vs 3	0.5 (0.3, 0.9)	0.9 (0.6, 1.4)	0.4 (0.3, 0.6)	1.1 (0.7, 1.6)
TravelerType 2 vs 3	0.8 (0.4, 1.3)	1.2 (0.8, 1.7)	0.6 (0.4, 1.0)	1.1 (0.7, 1.7)
Age 1 vs 2	1.0 (0.7, 1.6)	1.3 (1.0, 1.7)	1.9 (1.3, 2.7)	1.4 (1.0, 2.0)
Gender Female vs Male	2.2 (1.4, 3.5)	0.9 (0.7, 1.3)	1.2 (0.8, 1.7)	0.6 (0.4, 0.8)
Round R1 vs R2	0.9 (0.6, 1.4)	0.4 (0.2, 0.6)	3.0 (2.1, 4.2)	2.1 (1.3, 3.3)
Round R1 vs R3		0.3 (0.2, 0.5)		1.9 (1.3, 2.6)
Round R2 vs R3		0.9 (0.7, 1.2)		0.9 (0.6, 1.4)
DMSFrequency 1 vs 2	0.6 (0.3, 1.0)	0.9 (0.6, 1.3)	1.3 (0.8, 2.0)	0.7 (0.5, 1.0)
DMSFrequency 1 vs 3	1.4 (0.8, 2.6)	0.7 (0.5, 1.1)	1.1 (0.7, 1.7)	0.7 (0.5, 1.0)
DMSFrequency 2 vs 3	2.5 (1.5, 4.1)	0.8 (0.6, 1.2)	0.9 (0.6, 1.3)	1.0 (0.7, 1.4)
<i>R1 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	CLICK IT OR TICKET	MOVE OVER FOR HIGHWAY WORKERS	It's a Passing Lane...Not a Cruising Lane
<i>R2 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	It's No Trick, Seatbelts Are a Treat
<i>R3 Specified Message</i>		WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES		All Buckled, All Seats, All the Time

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week.

Value in bold means that the odds ratio is significantly different than 1.

General – Have these messages ever caused changes in your driving behavior?

This is also a general question that was not related to site-specific messages. Between 45 percent and 68 percent of travelers indicated the safety-related DMS messages had caused changes in their driving behavior.

Table 19. Responses to “Have these DMS messages ever caused changes in your driving behavior?” by Site.

State	Round	Number and Percentage of Survey Participants			
		Caused Changes	No Change	Invalid	Number of Participants
Nevada	R1	55%	43%	2%	204
	R2	48%	47%	4%	93
Minnesota/ Wisconsin	R1	51%	46%	3%	160
	R2	52%	43%	5%	233
	R3	56%	42%	2%	289
Kansas	R1	68%	27%	5%	177
	R2	48%	46%	6%	216
Missouri	R1	59%	40%	2%	181
	R2	45%	52%	3%	102
	R3	49%	50%	1%	282
All Participants		1039 (54%)	835 (43%)	63 (3%)	1937

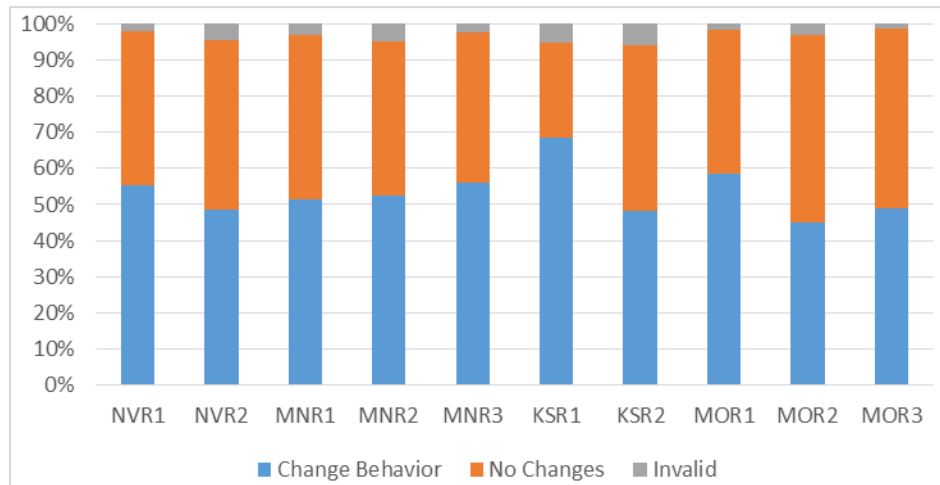


Figure 17. Graph. Participant Responses Regarding whether Safety-Related DMS Cause Behavior Changes.

The probability of the safety-related DMS messages causing driving changes was modeled, and results are presented in Table 20 and Figure C-21 through Figure C-24 in Appendix C. At most sites, except Missouri, infrequent travelers were significantly less likely to change their driving behavior due to the safety-related DMS messages. In Kansas, young travelers and also female travelers were more likely to change their driving because of the DMS messages. Generally, travelers observing DMS less frequently were less likely to change their driving behavior. This may reflect the benefit of a driver seeing specific safety campaign messages more frequently, such that seeing a message advocating for a given topic will eventually lead to a behavior change.

Table 20. Odds Ratios and 95 Percent Confidence Limits – Behavior Hypothesis on Whether DMS Messages Cause Changes in Driving Behavior by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	0.6 (0.4, 1.0)	0.8 (0.6, 1.0)	0.6 (0.4, 0.9)	0.9 (0.6, 1.2)
TravelerType 1 vs 3	0.9 (0.6, 1.5)	1.0 (0.7, 1.4)	0.9 (0.6, 1.4)	1.0 (0.7, 1.4)
TravelerType 2 vs 3	1.5 (0.9, 2.4)	1.3 (1.0, 1.7)	1.5 (0.9, 2.4)	1.1 (0.8, 1.6)
Age 1 vs 2	1.1 (0.8, 1.5)	1.2 (1.0, 1.5)	1.5 (1.1, 2.0)	1.2 (0.9, 1.5)
Gender Female vs Male	1.5 (1.0, 2.3)	1.2 (0.9, 1.6)	1.6 (1.1, 2.2)	0.8 (0.6, 1.1)
Round R1 vs R2	1.3 (0.9, 1.9)	0.9 (0.7, 1.2)	2.6 (1.9, 3.6)	1.7 (1.2, 2.4)
Round R1 vs R3		0.8 (0.6, 1.1)		1.4 (1.1, 1.9)
Round R2 vs R3		0.9 (0.7, 1.2)		0.8 (0.6, 1.2)
DMSFrequency 1 vs 2	0.6 (0.4, 0.9)	1.0 (0.7, 1.4)	1.2 (0.8, 1.8)	0.5 (0.4, 0.7)
DMSFrequency 1 vs 3	1.1 (0.7, 1.8)	0.9 (0.6, 1.2)	0.7 (0.4, 1.0)	0.7 (0.5, 0.9)
DMSFrequency 2 vs 3	1.9 (1.2, 3.0)	0.9 (0.7, 1.1)	0.6 (0.4, 0.9)	1.3 (0.9, 1.8)

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week.

Value in bold means that the odds ratio is significantly different than 1.

EVALUATION OF TRAVELER OPINIONS

- Hypothesis: Travelers believe that DMS for safety awareness and PSA messages are appropriate.
 - Question: Do you agree that the message is appropriate?
- Hypothesis: Travelers believe that DMS should only be used for traffic-related messages. Travelers believe that it would be more effective and/or less distracting to motorists to disseminate safety awareness messages and PSAs via other means.
 - Question: What types of message do you think should be displayed on DMS?
- Hypothesis: Travelers believe that it would be more effective and/or less distracting to motorists to disseminate safety awareness messages and PSAs via other means.
 - Question: Which way of communicating safety-related information do you think is best?
- Hypothesis: Travelers perceive a value of safety awareness and PSA messages on DMS.
 - Question: Do you agree that the message raised your awareness of the issue?

Do you agree that the identified message is appropriate?

Site by Site

Travelers were asked their agreement on whether an identified message was appropriate. At least 85 percent of travelers agreed or strongly agreed that the identified message was appropriate, with Minnesota/Wisconsin site travelers resulting in the highest percentage at 93 percent.

Table 21. Number of Survey Participants per Corridor, and Percentage on Their Agreement on Whether the Identified Message is Appropriate.

State	Round	Number and Percentage of Survey Participants					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Nevada	R1	3%	1%	5%	22%	68%	201
	R2	2%	1%	8%	41%	48%	92
Minnesota/ Wisconsin	R1	3%	2%	3%	28%	65%	158
	R2	3%	1%	3%	37%	55%	233
	R3	3%	0%	4%	31%	62%	286
Kansas	R1	4%	2%	5%	29%	59%	170
	R2	4%	1%	6%	24%	65%	216
Missouri	R1	5%	1%	3%	34%	57%	178
	R2	1%	1%	8%	47%	43%	102
	R3	4%	3%	8%	33%	52%	280
All Participants		66 (3%)	25 (1%)	98 (5%)	607 (32%)	1120 (58%)	1916

Note: 21 participants did not provide inputs.

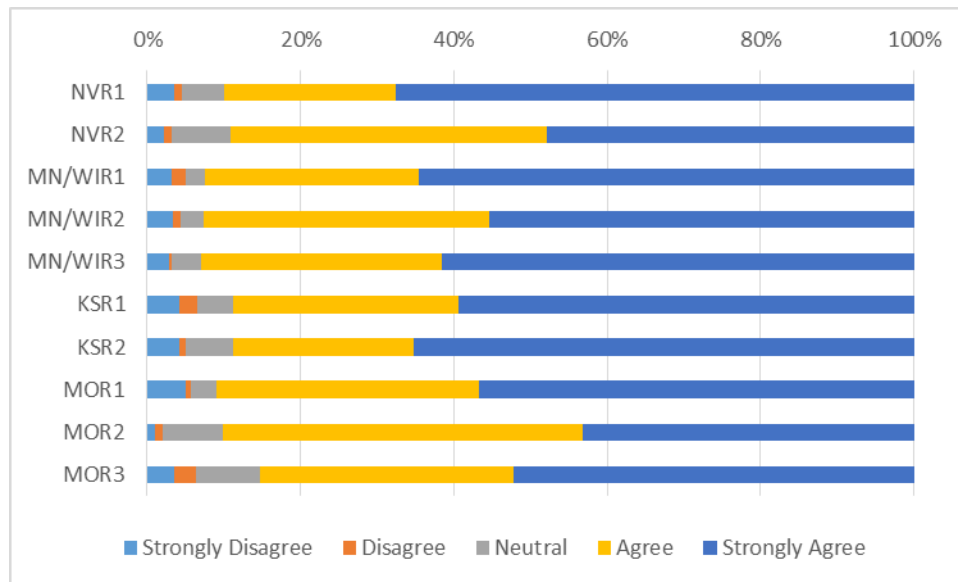


Figure 18. Graph. Agreement on Whether the Identified Message is Appropriate.

A binary logistic model was fit to the data with the probability of travelers agreeing or strongly agreeing that the message was appropriate as the response and traveler type, age, gender, round, and frequency of seeing safety-related message during general travels as the predictors, and results are presented in Table 22 and Figure C-25 through Figure C-28 in Appendix C.

No statistically significant differences were observed in terms of traveler type. Younger travelers were significantly less likely to consider the messages to be appropriate than older travelers in Kansas, Minnesota/Wisconsin and Missouri, while the opposite was found in Nevada.

Table 22. Odds Ratios and 95 Percent Confidence Limits – Opinions Hypothesis on Agreement that the Identified Message is Appropriate by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	1.5 (0.5, 4.6)	1.1 (0.5, 2.5)	1.4 (0.6, 3.1)	0.6 (0.2, 1.3)
TravelerType 1 vs 3	2.1 (0.6, 7.2)	1.2 (0.5, 3.0)	0.7 (0.3, 1.7)	0.8 (0.4, 1.7)
TravelerType 2 vs 3	1.4 (0.5, 3.9)	1.1 (0.5, 2.4)	0.5 (0.2, 1.2)	1.5 (0.6, 3.6)
Age 1 vs 2	3.0 (1.2, 7.2)	0.5 (0.3, 1.0)	0.4 (0.2, 0.8)	0.5 (0.3, 0.9)
Gender Female vs Male	1.1 (0.4, 2.9)	1.1 (0.5, 2.3)	2.5 (1.1, 5.7)	0.8 (0.5, 1.5)
Round R1 vs R2	1.4 (0.6, 3.1)	1.0 (0.5, 2.2)	1.1 (0.6, 2.1)	1.1 (0.5, 2.6)
Round R1 vs R3		0.8 (0.4, 1.7)		1.7 (0.9, 3.2)
Round R2 vs R3		0.8 (0.4, 1.6)		1.5 (0.7, 3.2)
DMSFrequency 1 vs 2	1.5 (0.5, 4.8)	0.6 (0.3, 1.5)	0.8 (0.3, 1.9)	0.6 (0.3, 1.1)
DMSFrequency 1 vs 3	1.3 (0.4, 4.4)	0.9 (0.4, 2.0)	1.0 (0.4, 2.3)	0.5 (0.3, 1.1)
DMSFrequency 2 vs 3	0.9 (0.4, 2.2)	1.4 (0.7, 3.1)	1.2 (0.5, 2.9)	1.0 (0.5, 2.1)
<i>R1 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	CLICK IT OR TICKET	MOVE OVER FOR HIGHWAY WORKERS	It's a Passing Lane...Not a Cruising Lane
<i>R2 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	It's No Trick, Seatbelts Are a Treat
<i>R3 Specified Message</i>		WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES		All Buckled, All Seats, All the Time

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week.

Value in bold means that the odds ratio is significantly different than 1.

Messages at All Sites

Survey respondents were presented a series of PSA messages that had been displayed in other survey corridors (e.g., Kansas respondents saw PSA messages that had been displayed in Minnesota/Wisconsin and Nevada), as well as a weather message. Findings show that over 90 percent of all respondents found all four of the messages to be appropriate. Participant responses in Figure 19 are presented so that they can be matched in the same category across sites. Note for Figure 19 that invalid means that conflicting responses were selected (i.e., selected both “None of these” and one of the messages); Messages from other sites means the respondent selected at least one message displayed at the other sites; Winter Weather means the respondent selected the winter weather message only; and Understand all/none of these is as stated.

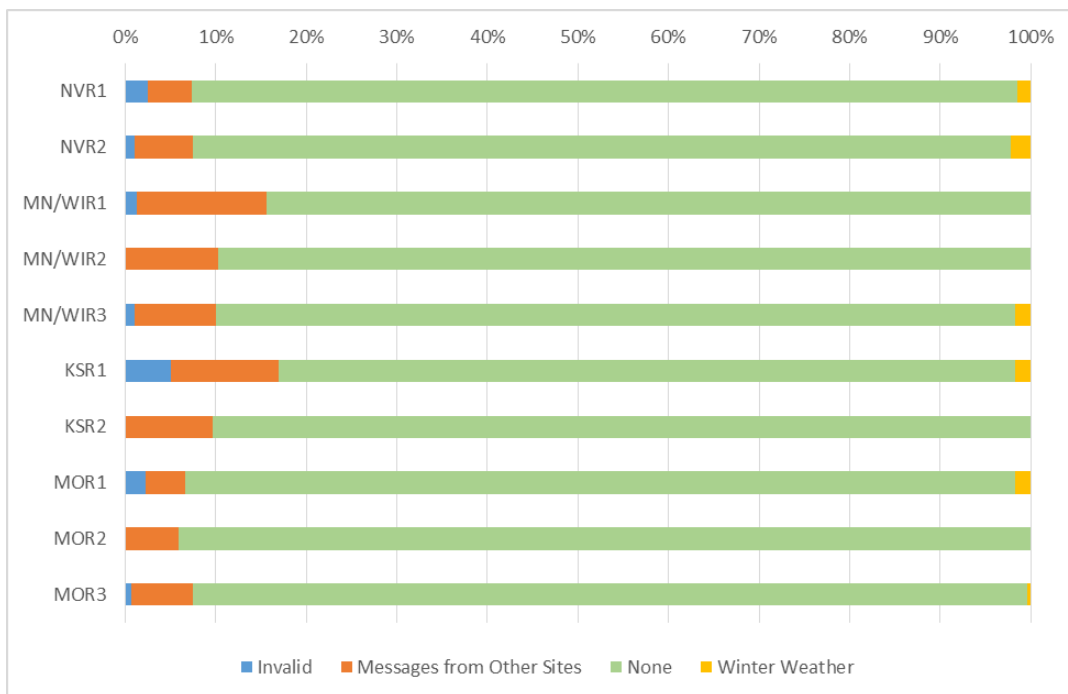


Figure 19. Graph. Respondent Opinions that Messages Displayed at Other Sites are Inappropriate.

Do you agree that the identified message raised your awareness of the issue?

Site by Site

When asked whether the identified message raised their awareness of the issue, at least 63 percent of travelers agreed or strongly agreed. The Minnesota/Wisconsin Round 2 survey had the highest percentage at 84 percent, while Missouri Round 3 had the smallest percentage at 63 percent.

Table 23. Number of Survey Participants per Corridor, and Percentage on Their Agreement on Whether the Identified Message Raised their Awareness of the Issue.

State	Round	Number and Percentage of Survey Participants					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Nevada	R1	5%	2%	19%	32%	41%	201
	R2	3%	5%	24%	34%	34%	92
Minnesota/ Wisconsin	R1	3%	6%	25%	31%	34%	158
	R2	3%	2%	11%	37%	47%	233
	R3	4%	2%	14%	37%	43%	286
Kansas	R1	5%	3%	16%	32%	44%	170
	R2	6%	6%	23%	25%	41%	216
Missouri	R1	3%	6%	21%	35%	34%	178
	R2	2%	7%	26%	33%	31%	102
	R3	5%	6%	25%	28%	35%	280
All Participants		81 (4%)	83 (4%)	376 (20%)	621 (32%)	755 (39%)	1916

Note: 21 participants did not provide inputs.

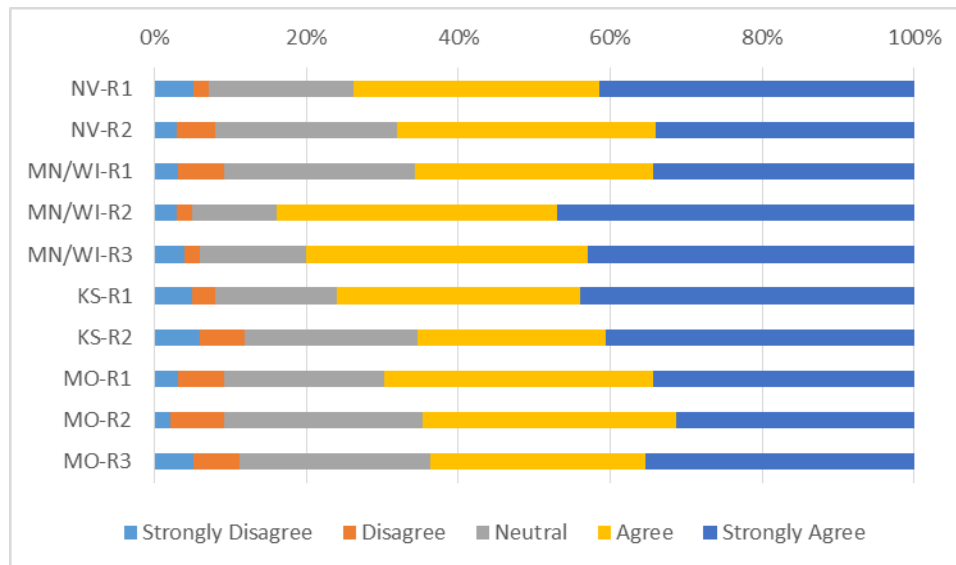


Figure 20. Graph. Agreement on Whether the Identified Message Raised Traveler Awareness of the Issue.

As shown in Table 24 and Figure C-29 through Figure C-32 in Appendix C, the logistic regression analysis about whether the message raised traveler awareness of the issue found no significant difference by traveler type; only in Kansas was a significant difference found due to gender. Also in Kansas, travelers seeing DMS frequently were observed to be significantly more likely to think the messages raise their awareness of the issue.

Table 24. Odds Ratios and 95 Percent Confidence Limits – Opinions Hypothesis that the Identified Message Raised their Awareness of the Issue by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	1.2 (0.6, 2.6)	0.7 (0.4, 1.1)	1.4 (0.8, 2.4)	0.6 (0.4, 1.1)
TravelerType 1 vs 3	1.6 (0.7, 3.6)	0.8 (0.4, 1.4)	0.9 (0.5, 1.7)	1.0 (0.6, 1.6)
TravelerType 2 vs 3	1.3 (0.7, 2.7)	1.2 (0.7, 2.0)	0.7 (0.3, 1.3)	1.5 (0.9, 2.6)
Age 1 vs 2	1.5 (0.9, 2.6)	0.8 (0.5, 1.2)	0.8 (0.5, 1.3)	0.9 (0.6, 1.4)
Gender Female vs Male	0.9 (0.5, 1.7)	1.3 (0.8, 2.0)	1.7 (1.0, 2.9)	1.4 (0.9, 2.1)
Round R1 vs R2	1.4 (0.8, 2.5)	0.4 (0.2, 0.6)	1.8 (1.1, 2.9)	1.2 (0.7, 2.1)
Round R1 vs R3		0.5 (0.3, 0.7)		1.3 (0.9, 1.9)
Round R2 vs R3		1.2 (0.8, 1.9)		1.1 (0.7, 1.7)
DMSFrequency 1 vs 2	0.6 (0.3, 1.3)	1.2 (0.7, 2.1)	0.5 (0.2, 0.9)	0.7 (0.4, 1.1)
DMSFrequency 1 vs 3	1.2 (0.6, 2.5)	1.0 (0.6, 1.7)	0.9 (0.5, 1.7)	0.8 (0.5, 1.2)
DMSFrequency 2 vs 3	1.9 (1.0, 3.9)	0.8 (0.5, 1.3)	2.0 (1.1, 3.7)	1.2 (0.7, 1.9)
R1 Specified Message	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	CLICK IT OR TICKET	MOVE OVER FOR HIGHWAY WORKERS	It's a Passing Lane...Not a Cruising Lane
R2 Specified Message	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	It's No Trick, Seatbelts Are a Treat
R3 Specified Message		WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES		All Buckled, All Seats, All the Time

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week.

Value in bold means that the odds ratio is significantly different than 1.

Messages at All Sites

Survey respondents were presented a series of PSA messages that had been displayed in other survey corridors (e.g., Kansas respondents saw PSA messages that had been displayed in Minnesota/Wisconsin and Nevada), as well as a weather message. Findings show that the majority of respondents found all messages to raise their awareness about an issue. Participant responses in Figure 21 are presented so that they can be matched in the same category across sites. Note for Figure 21 that invalid means that conflicting responses were selected (i.e., selected both “None of these” and one of the messages); Messages from other sites means the respondent selected at least one message displayed at the other sites; Winter Weather means the respondent selected the winter weather message only; and Understand all/none of these is as stated.

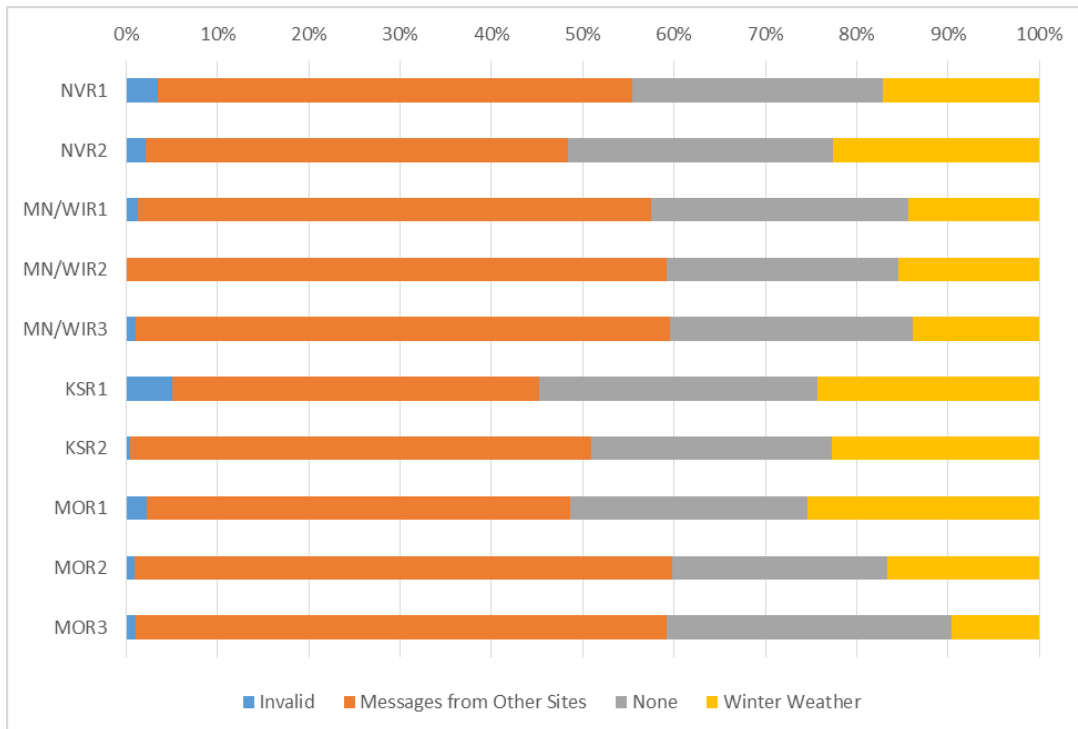


Figure 21. Graph. Respondent Opinions that Messages Displayed at Other Sites Increased their Awareness of an Issue.

Displaying safety campaign messages too frequently

Across all four sites, regarding the specific safety campaign messages being shown in the survey corridor 15.0 percent agreed or strongly agreed that the message was displayed too often. However, 24.7 percent agreed or strongly agreed that they were more likely to stop reading DMS after seeing this message multiple times. The responses for all survey rounds for these two questions are depicted in Figure 22 and Figure 23, respectively.

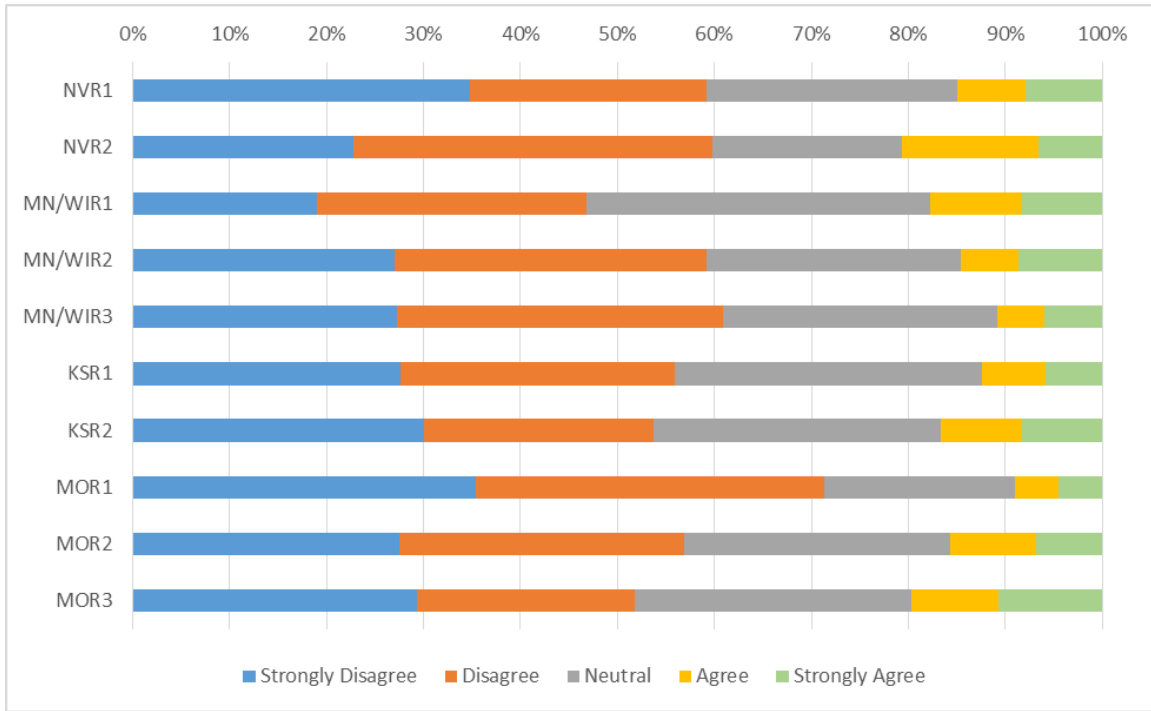


Figure 22. Graph. Responses for Each Survey Round about Whether the Specific Messages are Displayed too Often.

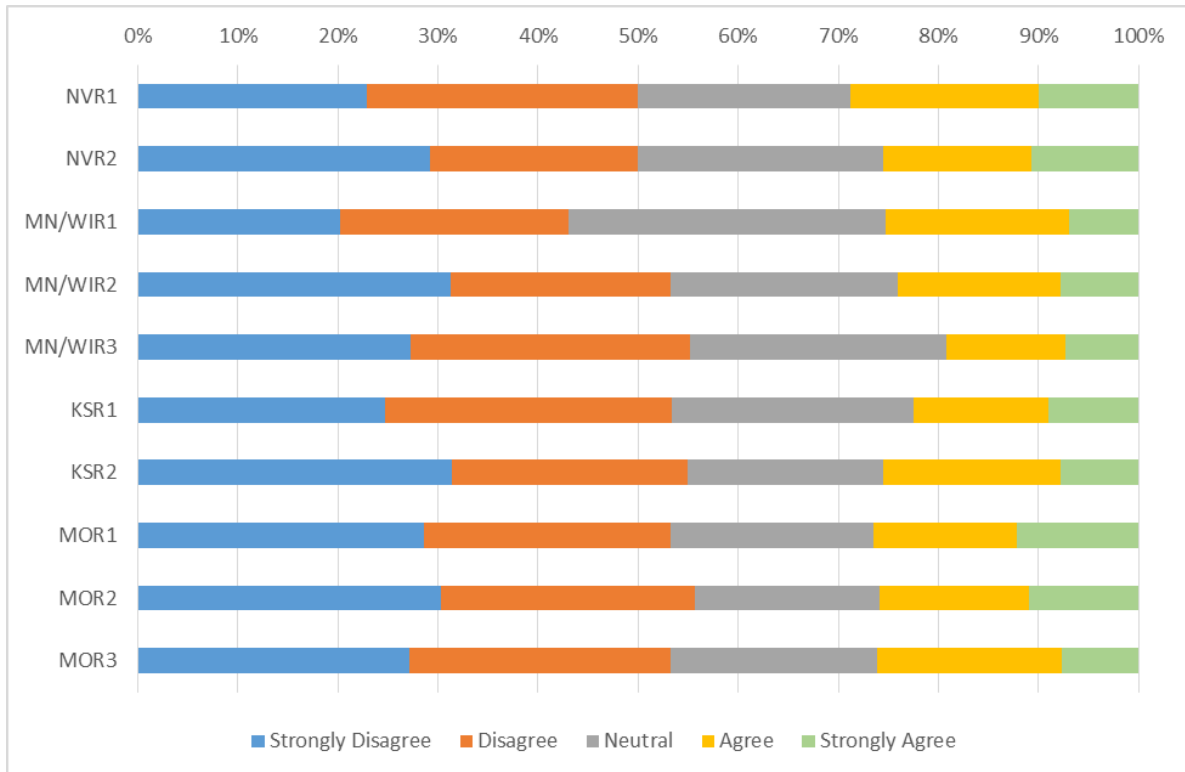


Figure 23. Graph. Responses about Whether Travelers are More Likely to Stop Reading DMS if the Same Message is Repeatedly Seen.

Which way of communicating safety-related information do you think is best?

Most travelers considered DMS as the best way to communicate safety-related information, followed by static signs. Given that travelers were taking a survey asking primarily about DMS, there may have been some bias toward this response.

Table 25. Number of Survey Participants per Corridor, and Percentage on the Best Way to Communicate Safety-related Information.

State	Round	Number and Percentage of Survey Participants					
		DMS	Online Ad./ Email	Printed Ad.	Radio/TV Ad.	Static Signs	Total
Nevada	R1	72%	3%	0%	5%	21%	199
	R2	74%	0%	0%	8%	18%	92
Minnesota/ Wisconsin	R1	65%	1%	2%	6%	26%	157
	R2	73%	0%	0%	7%	19%	233
	R3	78%	1%	1%	5%	15%	286
Kansas	R1	75%	2%	0%	5%	18%	169
	R2	71%	1%	0%	4%	25%	216
Missouri	R1	79%	4%	1%	2%	14%	177
	R2	64%	3%	1%	5%	27%	101
	R3	75%	1%	1%	5%	19%	280
All Participants		1401 (73%)	31 (2%)	12 (1%)	93 (5%)	373 (19%)	1910

Note: 27 participants did not provide inputs.

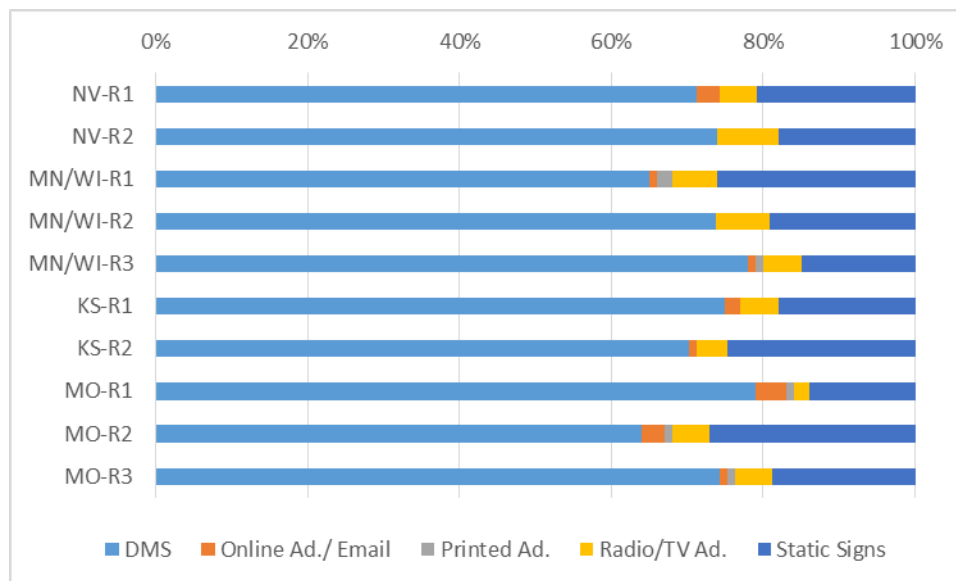


Figure 24. Graph. Responses on the Best Way of Communicating Safety-Related Information.

The probability of travelers considering DMS as the best communication of safety-related information was modeled, with results presented in Table 26 and Figure C-33 through Figure C-36 in Appendix C. Only in Minnesota/Wisconsin were significant impacts by traveler type observed: infrequent travelers had a significantly higher probability of thinking DMS was the best way to communicate safety-related information than truckers.

Table 26. Odds Ratios and 95 Percent Confidence Limits – Opinions Hypothesis on the Best Way to Communicate Safety-related Information by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	1.0 (0.5, 2.2)	1.5 (1.0, 2.5)	0.9 (0.5, 1.6)	0.8 (0.4, 1.4)
TravelerType 1 vs 3	1.4 (0.6, 3.0)	1.8 (1.1, 3.2)	0.8 (0.4, 1.6)	0.9 (0.5, 1.4)
TravelerType 2 vs 3	1.3 (0.7, 2.7)	1.2 (0.8, 1.9)	0.9 (0.5, 1.8)	1.1 (0.6, 2.1)
Age 1 vs 2	1.4 (0.8, 2.4)	0.8 (0.5, 1.1)	0.8 (0.5, 1.2)	0.8 (0.6, 1.3)
Gender Female vs Male	1.5 (0.8, 2.9)	1.1 (0.7, 1.7)	1.3 (0.8, 2.1)	1.3 (0.9, 2.1)
Round R1 vs R2	0.9 (0.5, 1.7)	0.7 (0.4, 1.0)	1.3 (0.8, 2.0)	2.0 (1.2, 3.5)
Round R1 vs R3		0.5 (0.3, 0.7)		1.3 (0.8, 2.1)
Round R2 vs R3		0.7 (0.5, 1.1)		0.7 (0.4, 1.1)
DMSFrequency 1 vs 2	1.0 (0.5, 2.2)	0.7 (0.4, 1.2)	1.3 (0.7, 2.3)	1.0 (0.6, 1.7)
DMSFrequency 1 vs 3	1.1 (0.5, 2.3)	0.7 (0.4, 1.2)	0.9 (0.5, 1.7)	0.7 (0.4, 1.2)
DMSFrequency 2 vs 3	1.1 (0.5, 2.1)	1.0 (0.6, 1.5)	0.7 (0.4, 1.3)	0.7 (0.4, 1.1)
<i>R1 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	CLICK IT OR TICKET	MOVE OVER FOR HIGHWAY WORKERS	It's a Passing Lane...Not a Cruising Lane
<i>R2 Specified Message</i>	OUR GOAL IS ZERO FATALITIES ON NEVADA ROADS	WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES	DON'T DRIVE DRUNK, ALCOHOL LAWS ENFORCED	It's No Trick, Seatbelts Are a Treat
<i>R3 Specified Message</i>		WI REMINDS YOU TO MOVE OVER FOR EMERGENCY VEHICLES		All Buckled, All Seats, All the Time

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week. Value in bold means that the odds ratio is significantly different than 1.

What types of messages do you think should be displayed on DMS?

The following table shows the percentage of participants who selected specific types of messages that should be displayed on DMS. Note that participants could select multiple message types:

- Traffic messages (e.g., congestion, travel time to a destination, accident), 89 percent;
- Safety-related messages (e.g., seat belts, distracted driving, work zone safety), 73 percent;
- Weather messages (e.g., severe storms, icy conditions, windy conditions), 85 percent;
- Missing person messages (e.g., AMBER alert, silver alert), 68 percent; and
- Other messages (e.g., call 511, special event notice, ozone action day), 33 percent.

The table shows the percentage of participants who picked traffic messages only, or thought the DMS should only display traffic messages. Traffic and weather messages had the highest percentage across the sites. However, a very small percentage (less than 10 percent) of the participants thought DMS should only display traffic messages.

Table 27. Percentage of Survey Participants on Message Types that should be Displayed on DMS.

State	Round	Number and Percentage of Survey Participants						
		Traffic	Safety-related	Weather	Missing Person	Other	Only Traffic	Total
Nevada	R1	85%	72%	86%	70%	39%	7%	199
	R2	82%	70%	90%	66%	32%	3%	92
Minnesota/ Wisconsin	R1	91%	73%	85%	57%	31%	4%	157
	R2	90%	74%	87%	66%	33%	6%	233
	R3	87%	73%	88%	71%	29%	5%	286
Kansas	R1	89%	78%	89%	69%	29%	4%	169
	R2	90%	75%	87%	73%	41%	6%	216
Missouri	R1	93%	77%	85%	69%	34%	8%	177
	R2	86%	75%	79%	65%	38%	7%	101
	R3	89%	68%	78%	68%	31%	10%	280
Participant Numbers		1693 (89%)	1400 (73%)	1627 (85%)	1301 (68%)	637 (33%)	120 (6%)	1910

Note: 27 participants did not provide inputs.

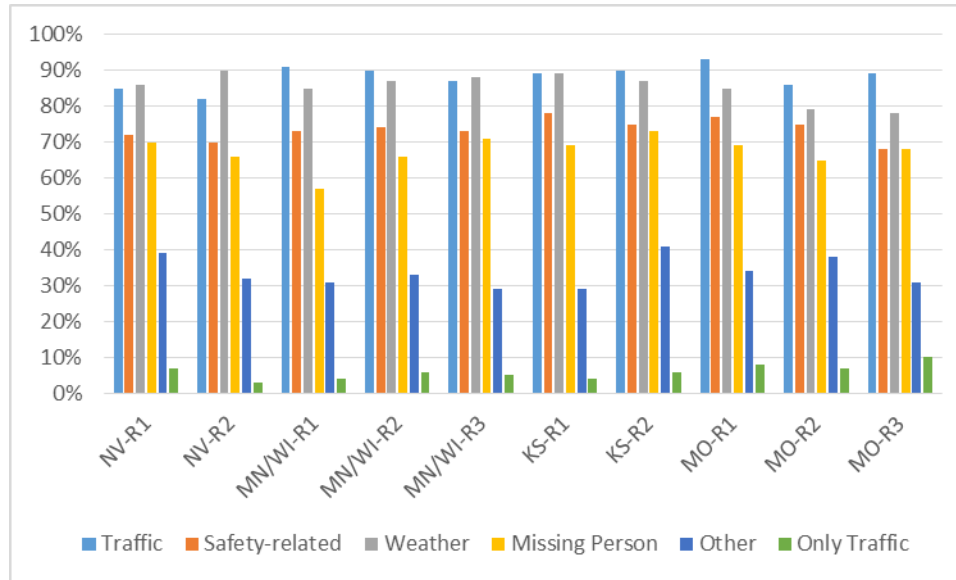


Figure 25. Graph. Responses on What Message Types should be Displayed on DMS.

The probability of travelers thinking DMS should only display traffic message was modeled versus those who think other messages should be displayed, with results presented in Table 28 and Figure C-37 through Figure C-40 in Appendix C. The impact by traveler type was not statistically significant. Younger travelers tended to be more likely to think the DMS should only display traffic messages and these differences were statistically significant in both Kansas and Missouri.

Table 28. Odds Ratios and 95 Percent Confidence Limits – Opinions Hypothesis on Message Types that should be Displayed on DMS by Site.

Label	NV	MN/WI	KS	MO
TravelerType 1 vs 2	1.1 (0.2, 5.2)	1.2 (0.5, 3.2)	3.5 (0.7, 17.0)	1.8 (0.6, 5.1)
TravelerType 1 vs 3	0.6 (0.2, 2.8)	0.8 (0.3, 2.5)	1.4 (0.4, 5.2)	1.0 (0.4, 2.1)
TravelerType 2 vs 3	0.6 (0.1, 2.6)	0.7 (0.3, 1.7)	0.4 (0.1, 2.4)	0.5 (0.2, 1.5)
Age 1 vs 2	1.8 (0.6, 5.4)	1.9 (0.9, 3.9)	3.2 (1.1, 9.6)	2.4 (1.2, 4.6)
Gender Female vs Male	0.4 (0.1, 1.7)	0.6 (0.2, 1.6)	1.0 (0.4, 2.8)	0.8 (0.4, 1.7)
Round R1 vs R2	2.4 (0.6, 8.8)	0.7 (0.3, 1.9)	0.6 (0.2, 1.7)	1.1 (0.4, 2.9)
Round R1 vs R3		1.0 (0.4, 2.6)		0.8 (0.4, 1.6)
Round R2 vs R3		1.4 (0.6, 3.1)		0.7 (0.3, 1.7)
DMSFrequency 1 vs 2	2.2 (0.5, 9.2)	0.6 (0.2, 1.6)	0.9 (0.3, 2.6)	1.7 (0.8, 3.8)
DMSFrequency 1 vs 3	2.4 (0.6, 10.4)	0.9 (0.3, 2.7)	2.6 (0.6, 11.2)	3.0 (1.3, 7.0)
DMSFrequency 2 vs 3	1.1 (0.3, 4.5)	1.6 (0.7, 3.5)	3.1 (0.7, 12.8)	1.7 (0.7, 4.2)

Note: TravelerType 1 = Infrequent, TravelerType 2 = Frequent, TravelerType 3 = Truckers; Age 1 = 16-55, age 2 = Over 55; DMSFrequency 1 = Less than 1 time per month, DMSFrequency 2 = 1-3 times per month, DMSFrequency 3 = One or more times per week. Value in bold means that the odds ratio is significantly different than 1.

DISCUSSION OF RESULTS

Table 29 summarizes specific hypotheses and findings for each of the evaluation areas of awareness, understanding, behavior changes and opinions. Overall, about 77 percent of travelers encountered by the survey team had seen a DMS, while about 79 percent indicated that they had observed at least one of the safety-related messages, which supports the awareness hypothesis. The understanding hypothesis was also supported, as over 79 percent of travelers were able to correctly interpret the presented message. An even higher percentage (92 percent) of respondents agreed or strongly agreed that the message was understandable. In terms of behavior, self-report survey data found that 23 percent of travelers changed their driving behavior after seeing the safety message, which in conjunction with 54 percent saying they have changed their behavior in the past after seeing a safety message, supports the behavior change hypothesis. Given relatively high compliance rates with safety laws and a generally safe traveling population, lower percentages are not surprising. The survey data also indicated that the display of a PSA on a DMS does not seem to cause travelers to slow down to read a message, with 18 percent of respondents reporting that they or others seem to slow down as they pass by these DMS messages. Two of the opinion hypotheses were supported: a high proportion of respondents believed that the safety awareness and PSA message posted at each site was appropriate (90 percent) and raised their awareness of the safety issue (71 percent). A small percentage of respondents (6 percent) indicated that only traffic-related messages should be shown on DMSs and most travelers considered DMS as the best way of communicating safety-related information to the public, which did not support the two related opinions hypotheses.

Further analyses were conducted to examine the differences between traveler types (infrequent travelers, frequent travelers, and truckers). In most sites, infrequent travelers have the highest level of awareness, followed by frequent travelers.

Table 29. Hypotheses and Evaluation Results.

Evaluation Area	Hypotheses	Results	Detail
Awareness	A significant percentage of travelers are aware that safety messages and PSAs are included on DMS	Supported	77% of travelers encountered by the survey team had seen a DMS.
	A significant percentage of travelers have observed an actual safety message and/or PSA on a DMS	Supported	79% of travelers from the four sites reported that they observed at least one of the safety-related messages. In most sites, infrequent travelers had the highest level of awareness, followed by frequent travelers and then truckers.
Understanding	Drivers can understand the messages on the DMS	Supported	79% of travelers interpreted the message correctly: truckers in Nevada had a significantly lower understanding level than other travelers, and infrequent travelers in Missouri had significantly lower understanding than frequent travelers. 92% of travelers agreed or strongly agreed that the message is understandable; Kansas and Nevada infrequent travelers were more likely than other travelers to consider the message as understandable.
Behavior Changes	The display of a PSA on a DMS does not cause traffic to slow down or other congestion	Partially Supported	18% of travelers thought that they “slow down” or are slowed down by other traffic because of these DMS messages. Minnesota/Wisconsin and Nevada infrequent travelers were significantly less likely to respond that the safety-related DMS messages cause them to slow down to read the message than frequent travelers and truckers. Infrequent travelers at most sites were significantly less likely to change their driving behavior due to the safety-related DMS messages. Young travelers and female travelers in Kansas were more likely to change their driving because of the DMS messages.
	The contents of the PSA cause a change in behavior by the travelers (e.g., more aware, looking for license plates for AMBER alerts, etc.)	Supported	23% of travelers indicated that they changed their behavior after seeing the specific identified messages in the corridor. 54% of travelers indicated that seeing safety campaign messages on DMSs had caused them to change their driving in the past. Given high compliance rates (e.g., seat belt usage), lower percentages were expected.

Evaluation Area	Hypotheses	Results	Detail
Opinions	Travelers believe that DMS for safety awareness and PSA messages are appropriate	Supported	90% of travelers agreed or strongly agreed that the specified safety message posted at each site was appropriate. Younger travelers were significantly less likely to consider the messages to be appropriate than older travelers in Kansas, Minnesota/ Wisconsin and Missouri, while the opposite was found in Nevada.
	Travelers believe that DMS should only be used for traffic-related messages	Not supported	6% of travelers thought that only transportation-related message should be displayed on DMSs. Impact by traveler type was not statistically significant; younger travelers tended to be more likely to think the DMS should only display traffic message and these differences were statistically significant in both Kansas and Missouri.
	Travelers believe that it would be more effective and/or less distracting to motorists to disseminate safety awareness messages and PSAs via other means	Not supported	73% of travelers indicated that DMS is the best way of communicating safety-related information. Only in Minnesota/Wisconsin were significant impacts observed: infrequent travelers had a significantly higher probability of thinking DMS was the best way to communicate safety-related information than truckers.
	Travelers perceive a value of safety awareness and PSA messages on DMS	Supported	71% of travelers agreed or strongly agreed that the specified DMS message at each site raised their awareness of the issue. There was no significant difference by traveler type; only in Kansas was a significant difference found for females and also for travelers seeing DMS frequently to be more likely to think the messages raise their awareness of the issue.

RECOMMENDATIONS

The analysis presented above supports displaying public service announcements and safety messages on DMS in rural areas. Overall, 73 percent of surveyed travelers in rural areas support the use of DMS to display PSAs and safety-related information, and 73 percent think DMS are the best way to communicate that information. About 54 percent of respondents had changed their behavior due to a safety message being posted on DMS, which should enhance overall safety. In addition, few respondents felt that the specified PSAs and safety-related information were displayed too often. As such, this evaluation can generally validate current agency practices in the survey corridors for displaying safety messages and PSAs on rural DMS. However, on rural corridors with higher volumes, agencies may want to examine potential mobility and safety impacts caused by travelers slowing down to read DMS messages, given that a full 18 percent of respondents reported this occurring.

These findings also suggest that displaying safety messages and PSAs more frequently would generally not be detrimental. About 23 percent of survey respondents reported behavior changes after reading the safety message on the DMS, however given high compliance rates with seatbelt use, for example, a relatively low number is not surprising. Even a small percentage of travelers changing their behavior could result in a positive influence on highway safety. About 54 percent of survey respondents indicated that they had changed their behavior in the past after reading a safety message on a DMS. In addition, many travelers who responded that they did not change their behavior anecdotally responded that reading the safety message made them more conscious of driving in a safer manner.

More research is also needed to examine the benefits of displaying catchy messages versus traditional messages. Catchy messages were only displayed in one of the four survey corridors for the duration of the survey in that location, however insufficient data and other bias did not allow for a comprehensive assessment. Anecdotally, catchy messages were commented on by travelers surveyed in other States displaying traditional messages; most remembered those messages in a positive manner. However, catchy messages could also influence the negative comments about DMS being a distraction.

APPENDIX A – SITE QUESTIONNAIRES

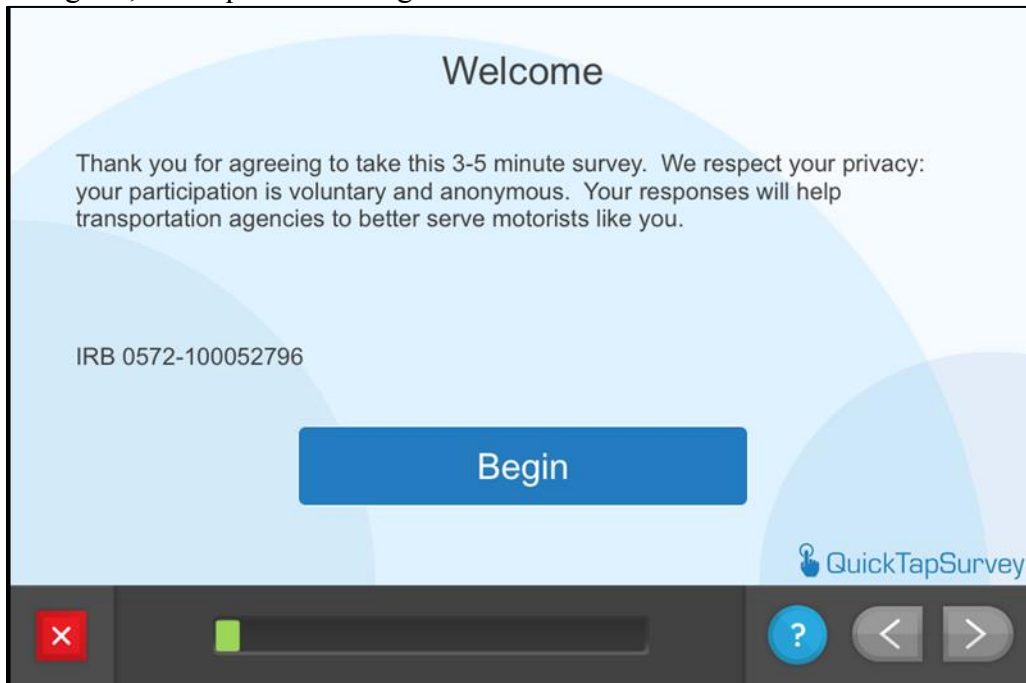
This section includes the full questionnaires used for each corridor presented as screenshots for the full questionnaire for each corridor as viewed on an iPad by the surveyed travelers using the QuickTap Survey application. An additional screen at the end of the survey allowed the survey administrator to enter any notes (e.g., participant did not respond beyond question 13), and for the initial surveys conducted in Nevada and Minnesota/Wisconsin, the participant's sex.

KANSAS, I-70

Screening question asked verbally: Did you happen to notice Dynamic Messages Signs on I-70 like the one in the picture that have safety-related messages?



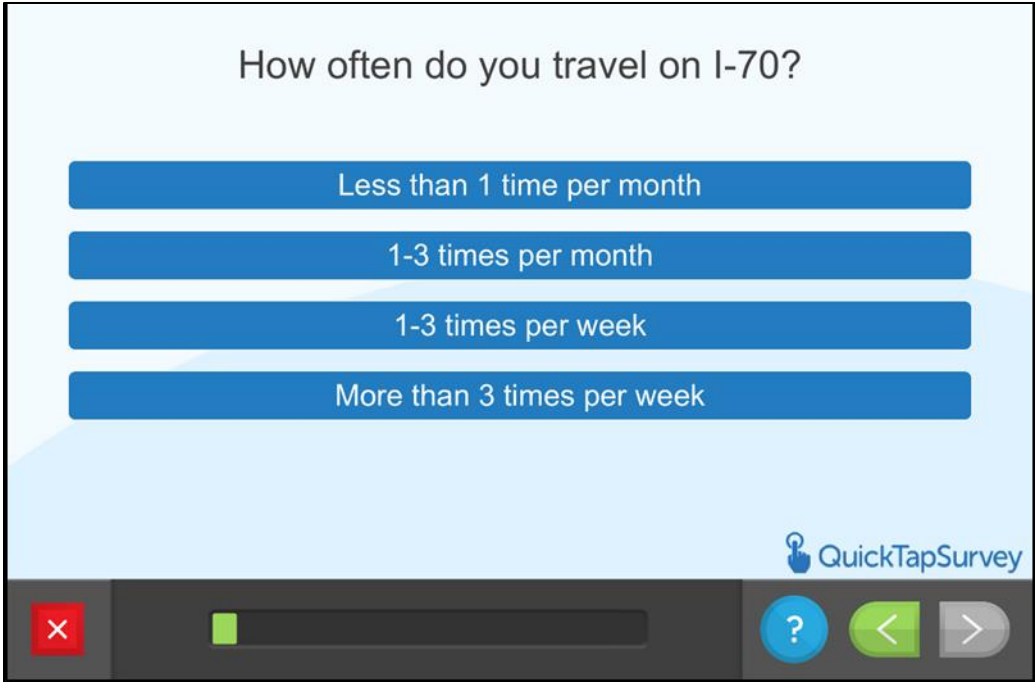
If eligible, main questionnaire given on an iPad:



How often do you travel on I-70?

- Less than 1 time per month
- 1-3 times per month
- 1-3 times per week
- More than 3 times per week

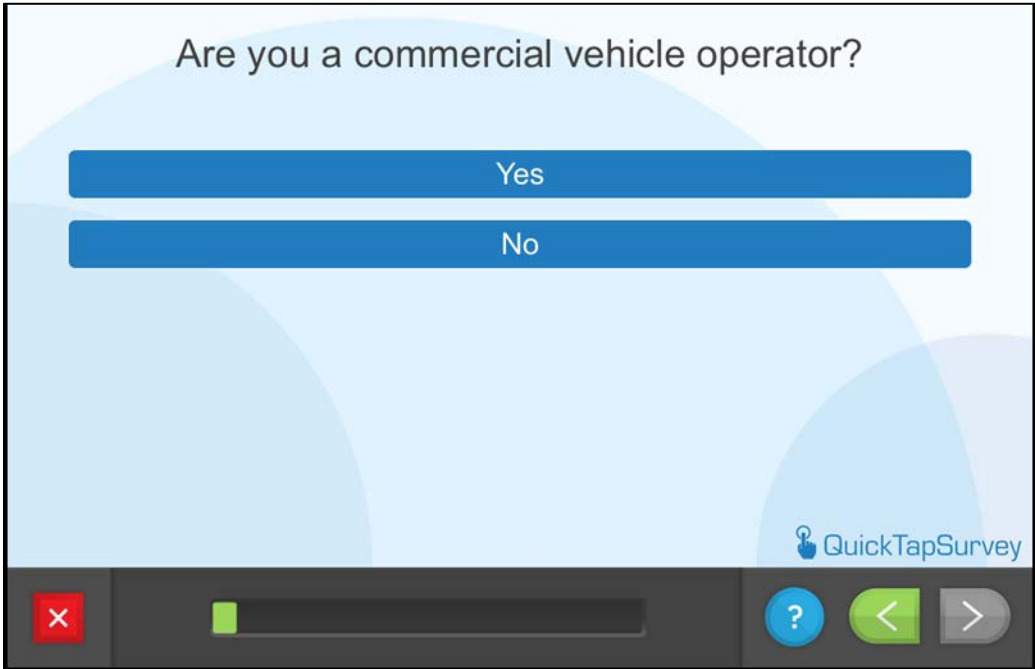
QuickTapSurvey



Are you a commercial vehicle operator?

- Yes
- No

QuickTapSurvey



Did you observe one of these safety-related messages on the Dynamic Message Signs on I-70?
(select all that apply)

SMOKING IS HARMFUL TO YOUR HEALTH

MOVE OVER FOR POLICE AND HIGHWAY WORKERS

MOVE OVER FOR EMERGENCY VEHICLES

No, none of these

QuickTapSurvey



After seeing the message(s) did you do anything differently?

Yes

No

QuickTapSurvey

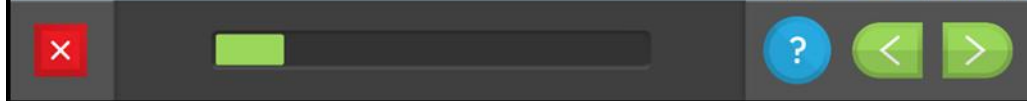


Follow-up question below, based on response. If yes:

What did you do? (select all that apply)

- Immediately change lanes
- Change my driving behavior
- Be more attentive when driving
- Other

QuickTapSurvey

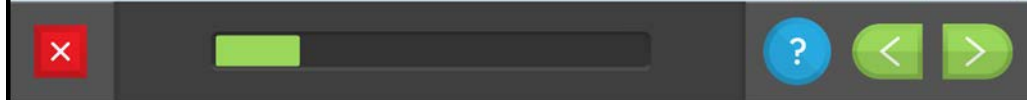


If no:

Why not? (select all that apply)

- I did not see any police or highway workers ahead
- I was already driving safely
- I did not understand the message
- Messages like this do not influence my decisions
- I do not know

QuickTapSurvey



About how often do you see safety campaign messages on these Dynamic Message Signs?

Less than 1 time per month

1-3 times per month

1-3 times per week

More than 3 times per week

QuickTapSurvey



(select all that apply) Have these Dynamic Message Signs ever:

Been difficult for you to read

Been hard to understand

Caused you to slow down in order to read the message

Caused other traffic to slow down to read the message

Do nothing

QuickTapSurvey



(select all that apply) Has seeing one of these Dynamic Message Signs ever caused you to:

Slow down	Put on your seat belt
Ask passengers to put on a seat belt	Be more attentive when driving
Change your driving behavior	Become distracted from driving
Decide not to drive after drinking	Do nothing differently

QuickTapSurvey

Navigation: [Close] [Progress] [Help] [Previous] [Next]

What does "Move Over For Police and Highway Workers" mean to you?

Immediately after seeing signs like this, I need to safely change lanes for police or highway workers ahead
Any time I encounter police or highway workers, I need to safely change lanes
I need to pull to the side of the road to let police or highway worker vehicles pass me
I am not sure

QuickTapSurvey

Navigation: [Close] [Progress] [Help] [Previous] [Next]

Indicate your level of agreement with the following statements pertaining to the "Move Over For Police and Highway Workers" message

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It was understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was appropriate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It raised my awareness of the issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is displayed too often	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to stop reading message signs after seeing this message multiple times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

QuickTapSurvey

Are there any of these messages that you do NOT understand? (select all that apply)

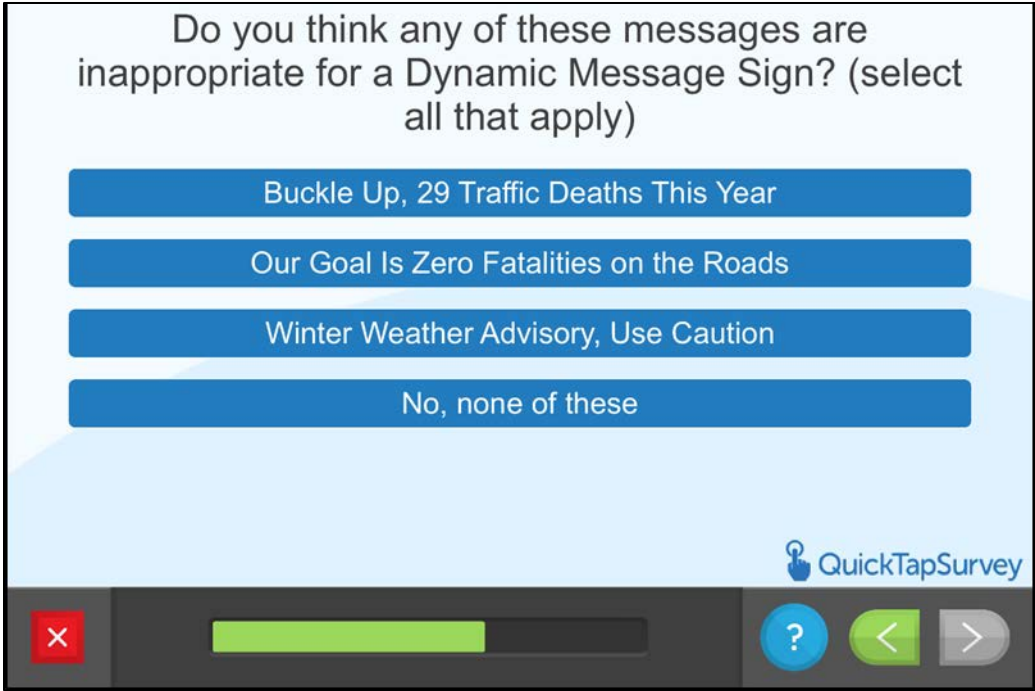
- Buckle Up, 29 Traffic Deaths This Year
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- I understand all of these

QuickTapSurvey

Do you think any of these messages are inappropriate for a Dynamic Message Sign? (select all that apply)

- Buckle Up, 29 Traffic Deaths This Year
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- No, none of these

QuickTapSurvey



Do any of these messages increase your awareness about an issue? (select all that apply)

- Buckle Up, 29 Traffic Deaths This Year
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- No, none of these

QuickTapSurvey



Which way of communicating safety-related information do you think is best?

- Static roadside signs
- Dynamic message signs
- Radio/TV advertisements
- Printed advertisements (newspaper, magazine)
- Online advertisements or email

QuickTapSurvey

What types of messages do you think should be displayed on Dynamic Message Signs? (select all that apply)

- Traffic messages (congestion, travel time to a destination, accident)
- Safety-related messages (seat belts, distracted driving, work zone safety)
- Weather messages (severe storms, icy conditions, windy conditions)
- Missing person messages (AMBER alert, silver alert)
- Other messages (call 511, special event notice, ozone action day)

QuickTapSurvey

What is your age?

16-25

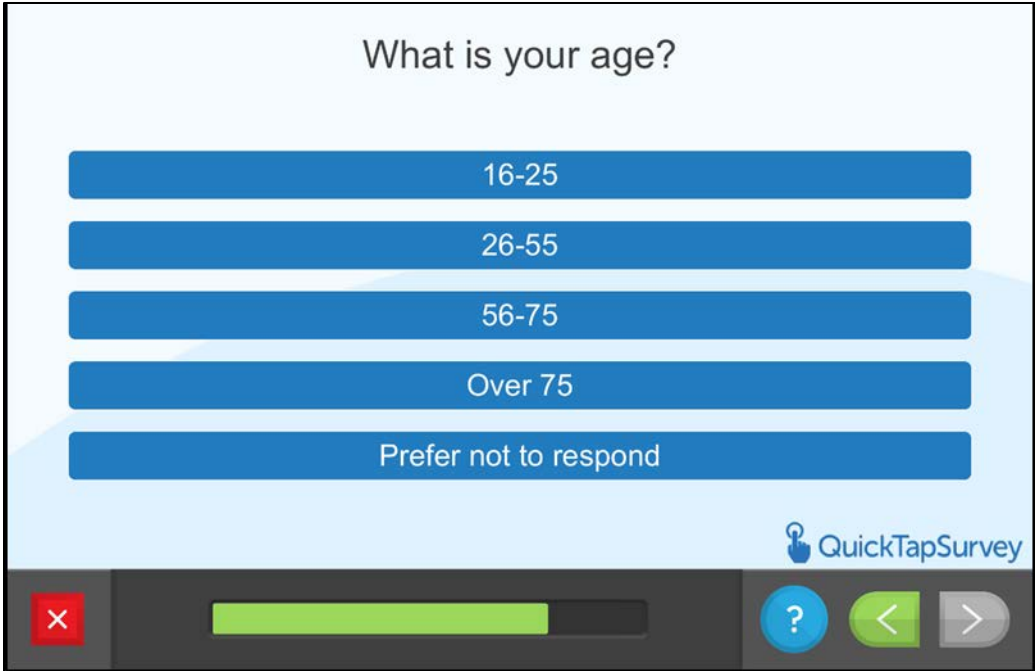
26-55

56-75

Over 75

Prefer not to respond

QuickTapSurvey

The image shows a survey question titled "What is your age?". Below the title are five blue horizontal buttons with white text: "16-25", "26-55", "56-75", "Over 75", and "Prefer not to respond". At the bottom right of the question area is the "QuickTapSurvey" logo. Below the question area is a dark grey navigation bar containing a red square with a white 'x', a green progress bar, a blue circle with a white question mark, a green left arrow, and a grey right arrow.

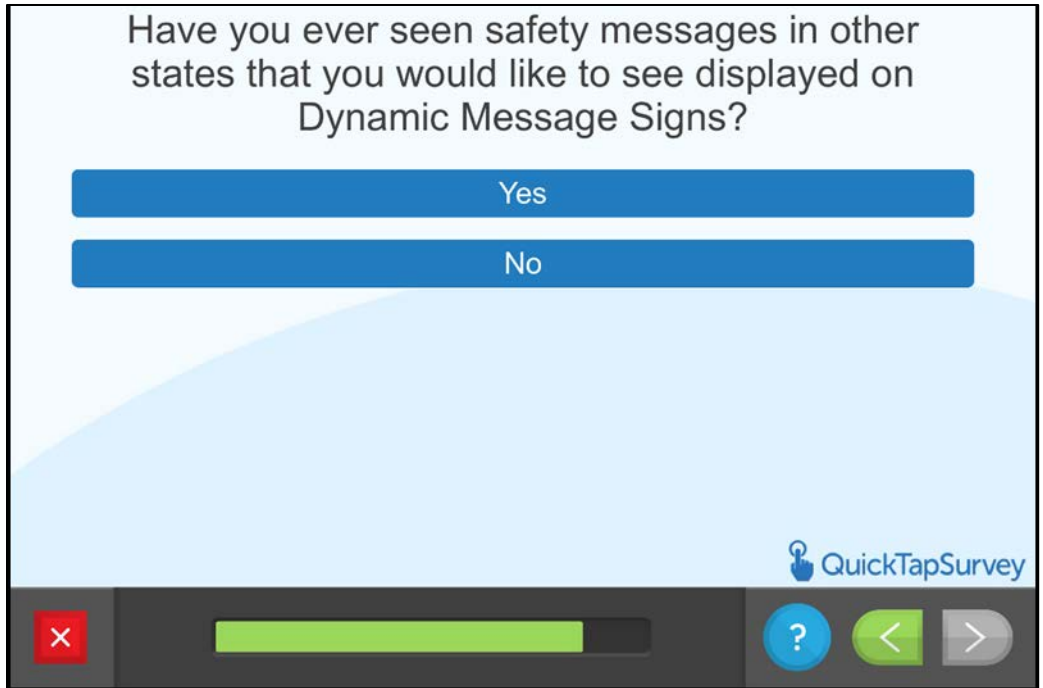
What is your sex?

Female

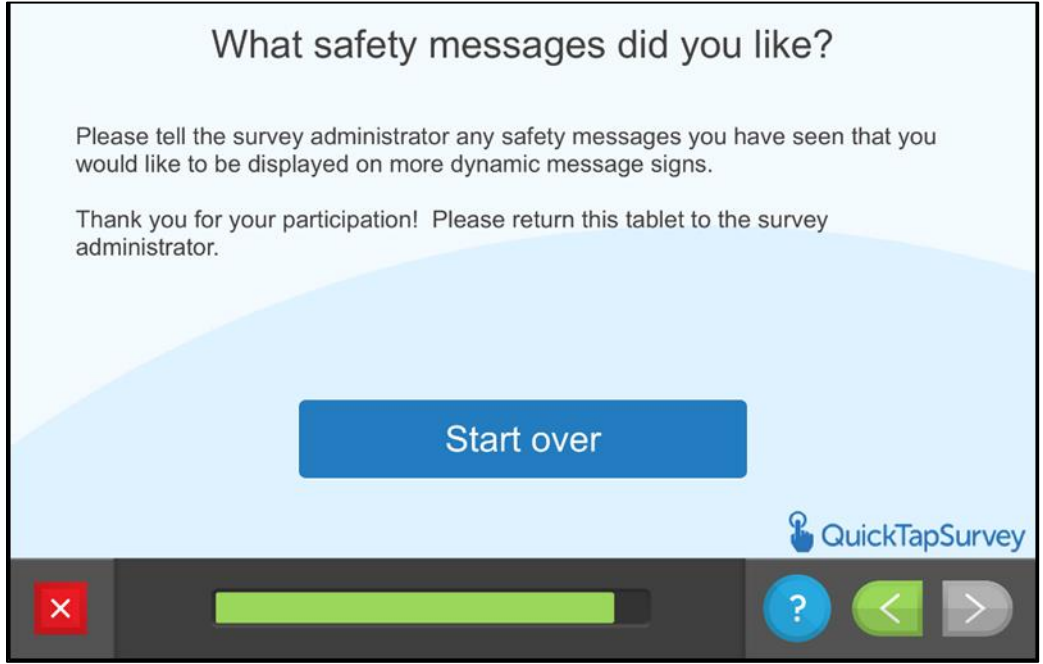
Male

QuickTapSurvey

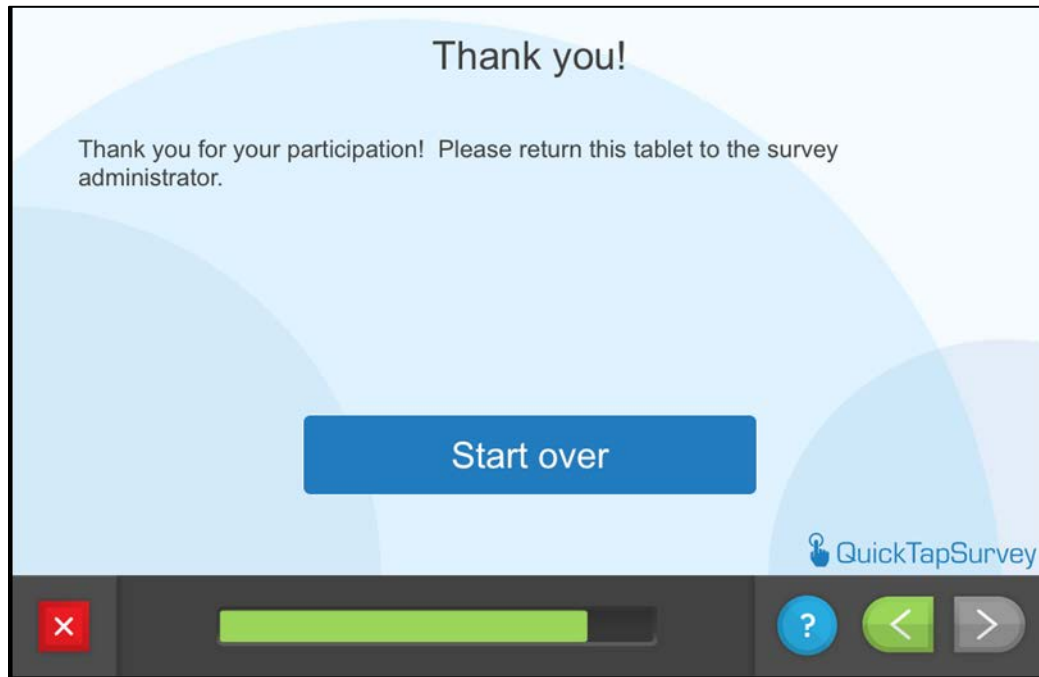
The image shows a survey question titled "What is your sex?". Below the title are two blue horizontal buttons with white text: "Female" and "Male". At the bottom right of the question area is the "QuickTapSurvey" logo. Below the question area is a dark grey navigation bar containing a red square with a white 'x', a green progress bar, a blue circle with a white question mark, a green left arrow, and a grey right arrow.



Follow-up screens to previous question, based on response. If yes:



If no:

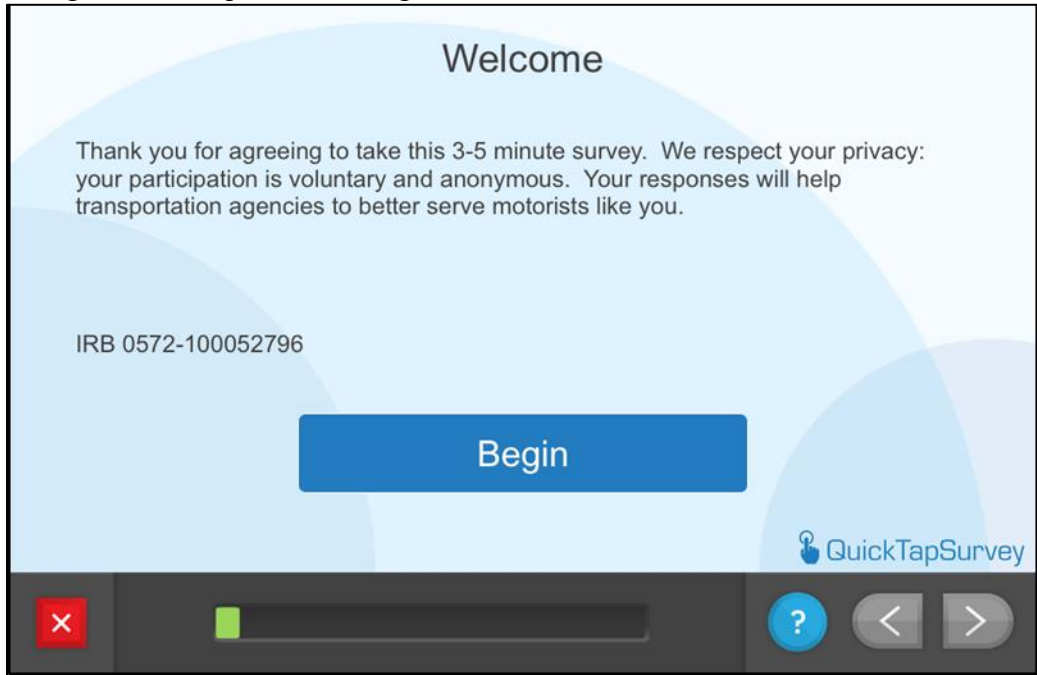


MINNESOTA/WISCONSIN, I-94

Screener question asked verbally: Did you happen to notice Dynamic Messages Signs on I-94 like the one in the picture that have safety-related messages?



If eligible, main questionnaire given on an iPad:

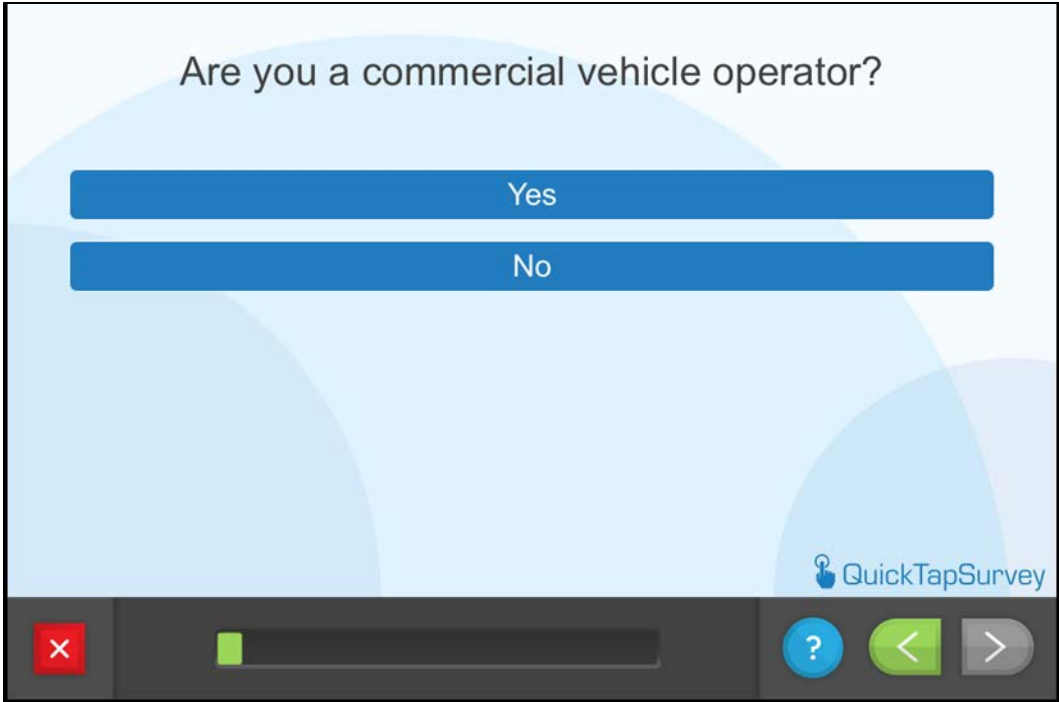


Are you a commercial vehicle operator?

Yes

No

QuickTapSurvey



Did you observe one of these safety-related message on the Dynamic Message Signs on I-94?
(select all that apply)

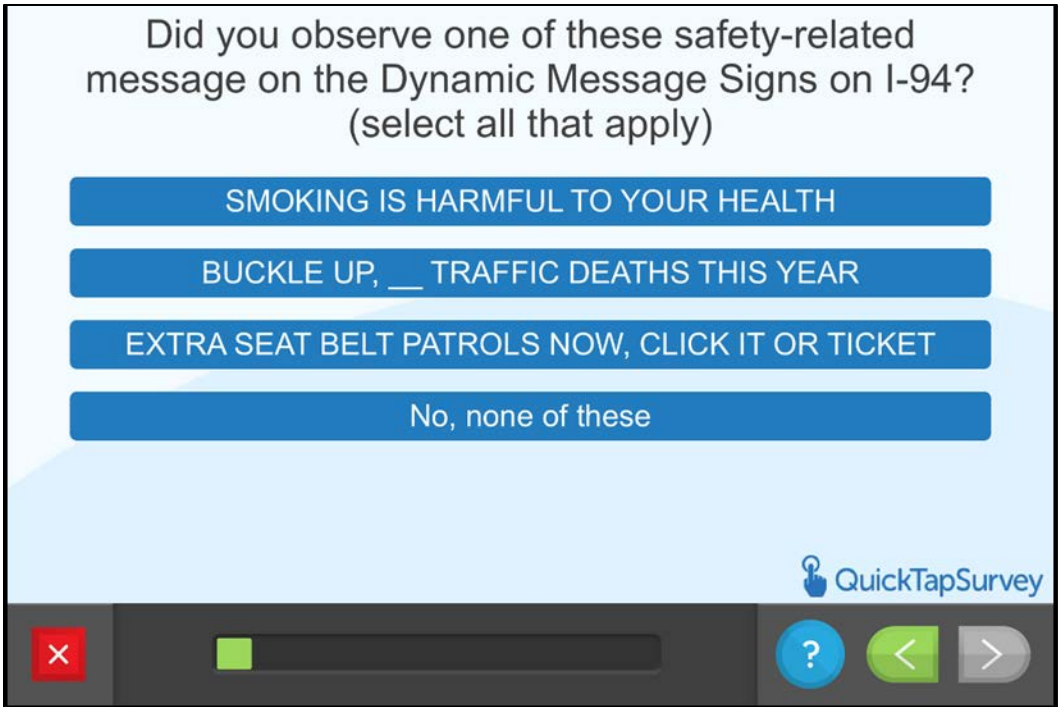
SMOKING IS HARMFUL TO YOUR HEALTH

BUCKLE UP, __ TRAFFIC DEATHS THIS YEAR

EXTRA SEAT BELT PATROLS NOW, CLICK IT OR TICKET

No, none of these

QuickTapSurvey

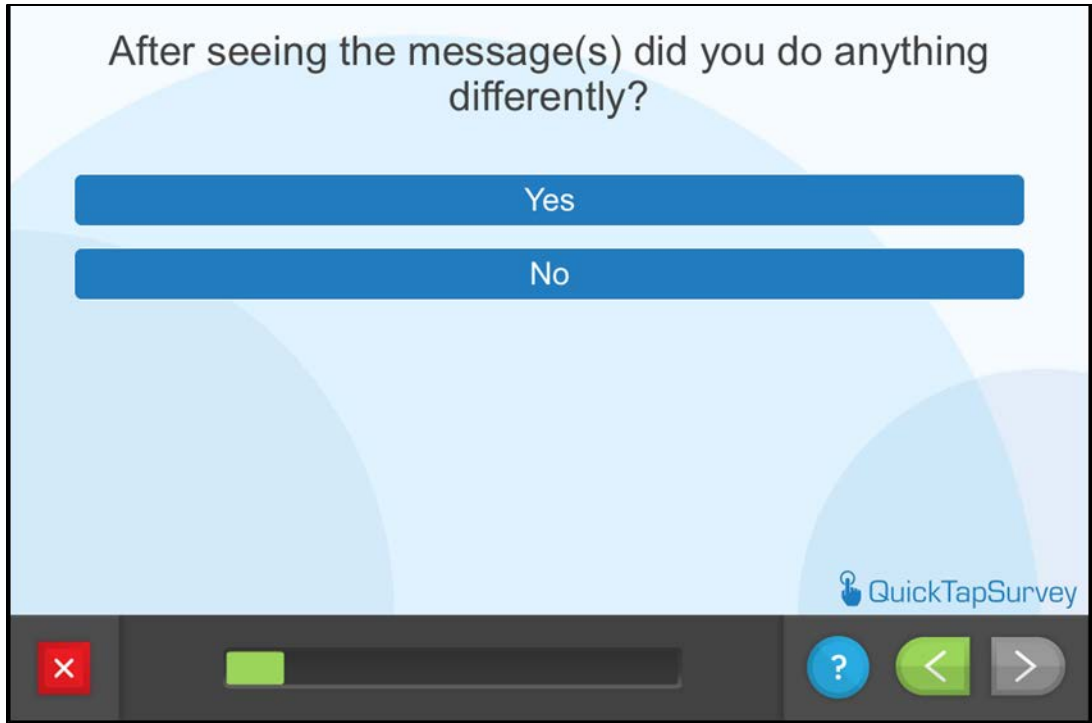


After seeing the message(s) did you do anything differently?

Yes

No

QuickTapSurvey



Follow-up question below, based on response. If yes:

What did you do? (select all that apply)

Slowed down

Be more attentive when driving

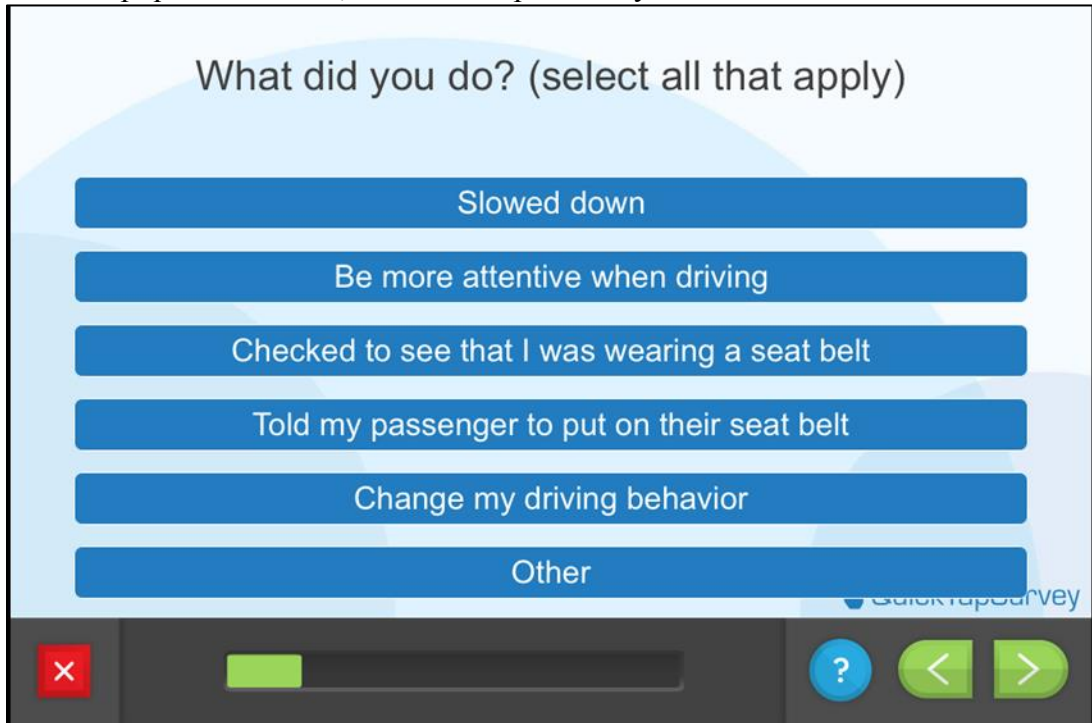
Checked to see that I was wearing a seat belt

Told my passenger to put on their seat belt

Change my driving behavior

Other

QuickTapSurvey

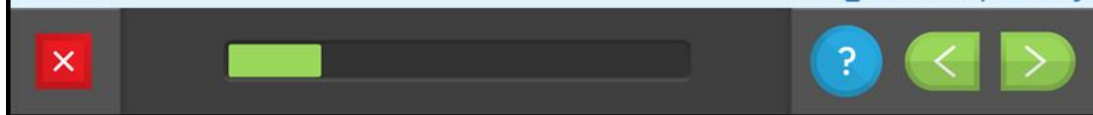


If no:

Why not? (select all that apply)

- I was already wearing my seat belt
- I was already driving safely
- I did not understand the message
- Messages like this do not influence my decisions
- I have not seen police pulling people over in this area
- I do not know

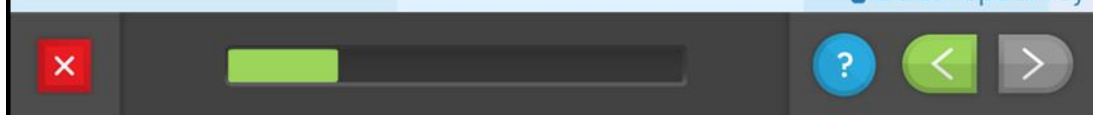
QuickTapSurvey



About how often do you see safety campaign messages on these Dynamic Message Signs?

- Less than 1 time per month
- 1-3 times per month
- 1-3 times per week
- More than 3 times per week

QuickTapSurvey



(select all that apply) Have these Dynamic Message Signs ever:

Been difficult for you to read

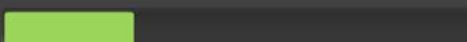
Been hard to understand

Caused you to slow down in order to read the message

Caused other traffic to slow down to read the message

Do nothing

QuickTapSurvey



(select all that apply) Has seeing one of these Dynamic Message Signs ever caused you to:

Slow down

Put on your seat belt

Ask passengers to put on a seat belt

Be more attentive when driving

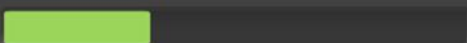
Change your driving behavior

Become distracted from driving

Decide not to drive after drinking

Do nothing differently

QuickTapSurvey



What does "Click It Or Ticket" mean to you?

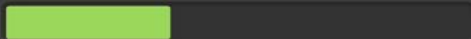
I may receive a ticket for not using my turn signal when changing lanes

I may receive a ticket for not wearing my seat belt

I may receive a ticket for not having a load on my car securely tied down

I am not sure

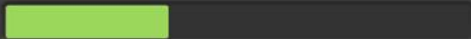
 QuickTapSurvey



Indicate your level of agreement with the following statements pertaining to the "Click It or Ticket" message

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It was understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was appropriate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It raised my awareness of the issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is displayed too often	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to stop reading message signs after seeing this message multiple times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

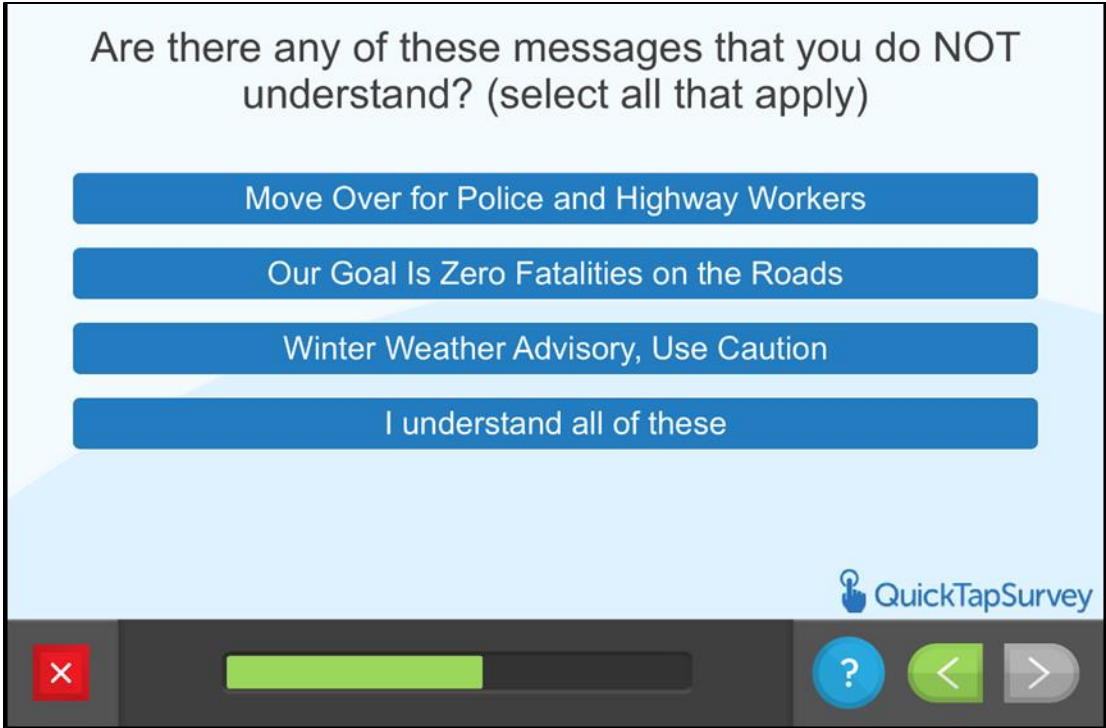
 QuickTapSurvey



Are there any of these messages that you do NOT understand? (select all that apply)

- Move Over for Police and Highway Workers
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- I understand all of these

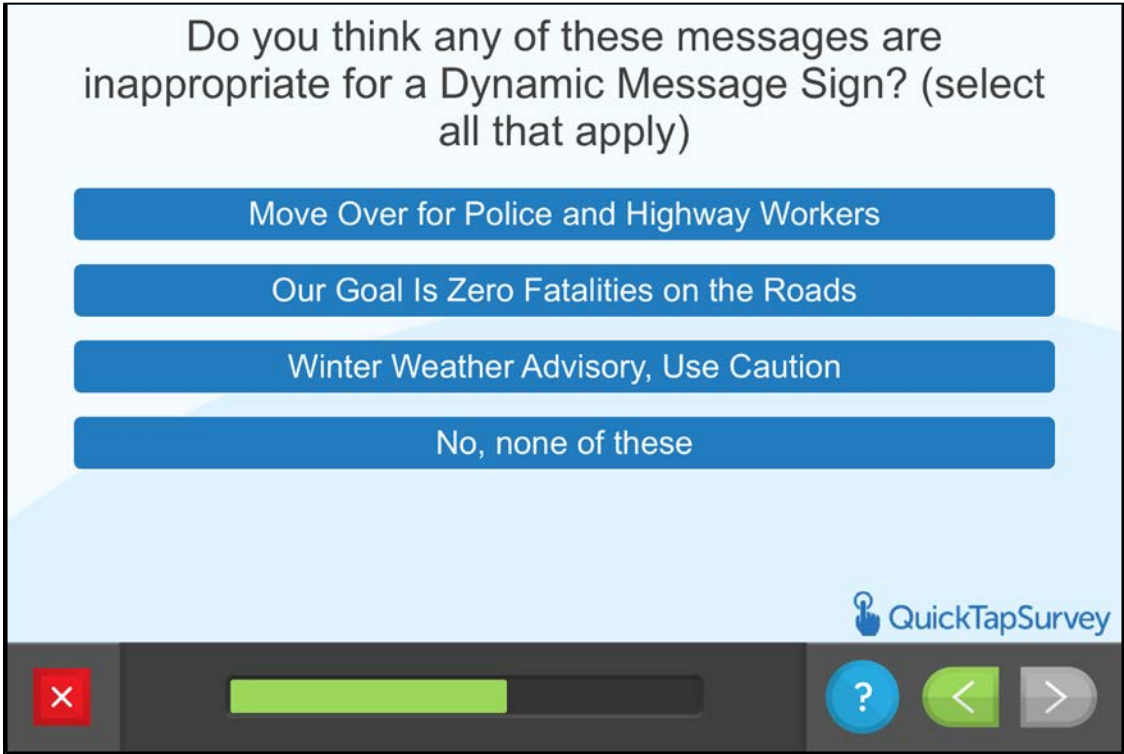
QuickTapSurvey



Do you think any of these messages are inappropriate for a Dynamic Message Sign? (select all that apply)

- Move Over for Police and Highway Workers
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- No, none of these

QuickTapSurvey



Do any of these messages increase your awareness about an issue? (select all that apply)

Move Over for Police and Highway Workers

Our Goal Is Zero Fatalities on the Roads

Winter Weather Advisory, Use Caution

No, none of these

 QuickTapSurvey



Which way of communicating safety-related information do you think is best?

Static roadside signs

Dynamic message signs

Radio/TV advertisements

Printed advertisements (newspaper, magazine)

Online advertisements or email

 QuickTapSurvey



What types of messages do you think should be displayed on Dynamic Message Signs? (select all that apply)

Traffic messages (congestion, travel time to a destination, accident)

Safety-related messages (seat belts, distracted driving, work zone safety)

Weather messages (severe storms, icy conditions, windy conditions)

Missing person messages (AMBER alert, silver alert)

Other messages (call 511, special event notice, ozone action day)

QuickTapSurvey



The next questions will ask about portable message signs like this.

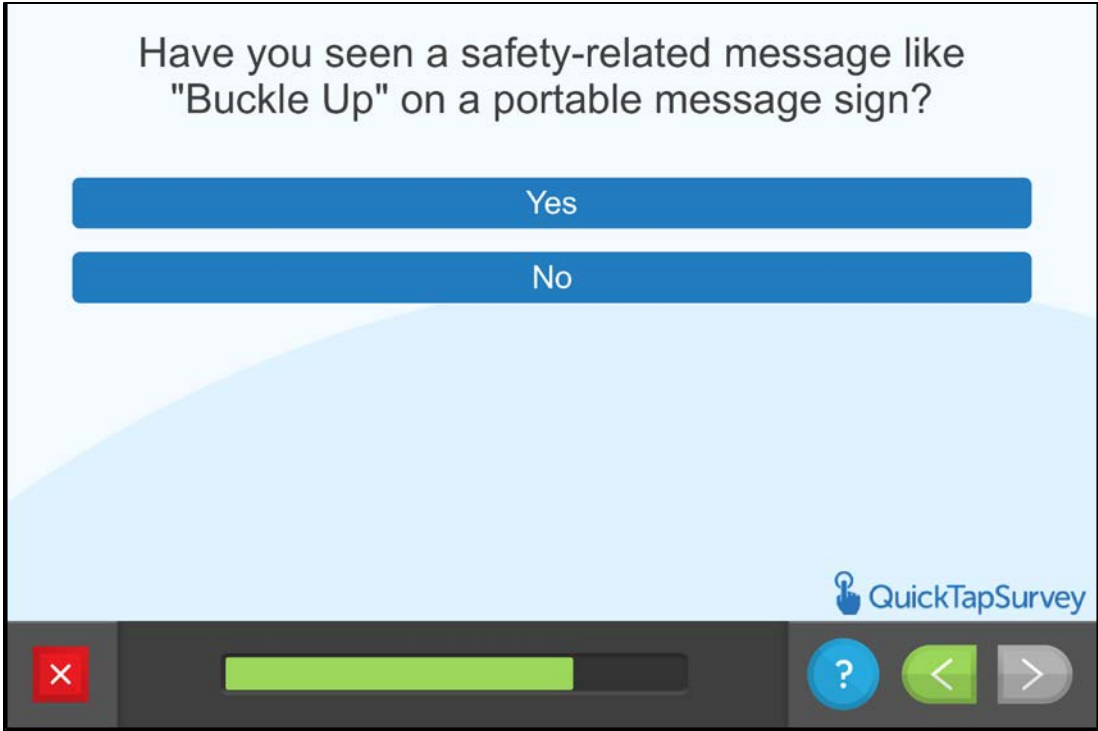


Have you seen a safety-related message like "Buckle Up" on a portable message sign?

Yes

No

QuickTapSurvey



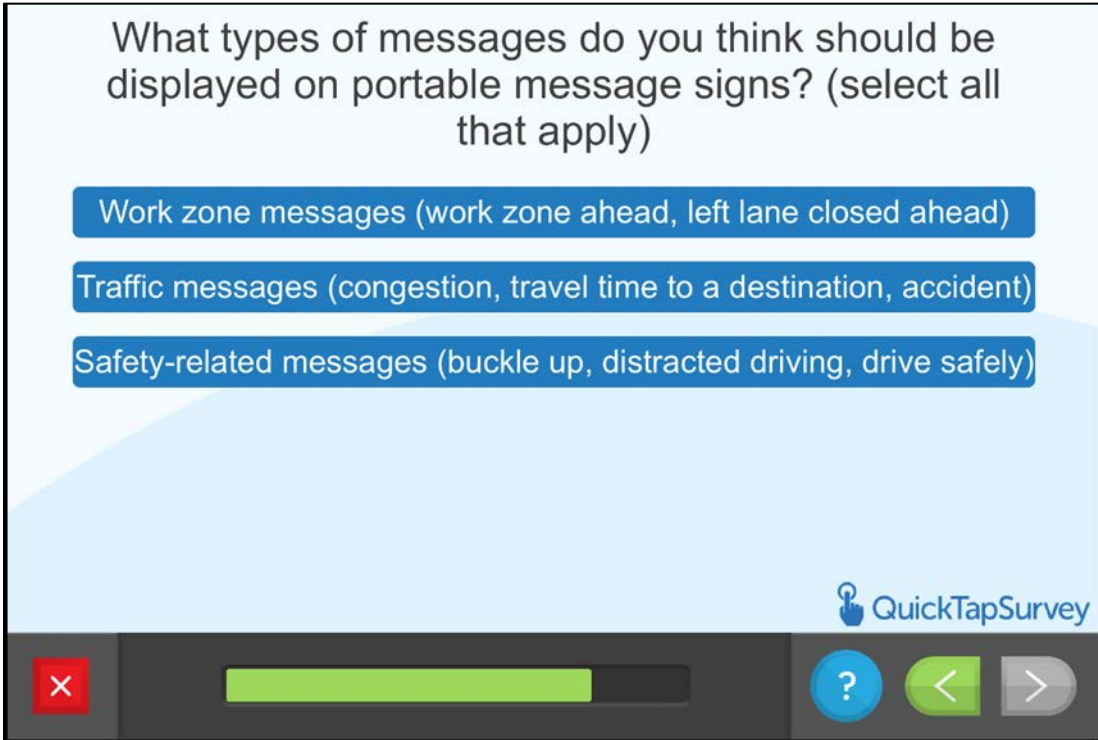
What types of messages do you think should be displayed on portable message signs? (select all that apply)

Work zone messages (work zone ahead, left lane closed ahead)

Traffic messages (congestion, travel time to a destination, accident)

Safety-related messages (buckle up, distracted driving, drive safely)

QuickTapSurvey



What is your age?

16-25

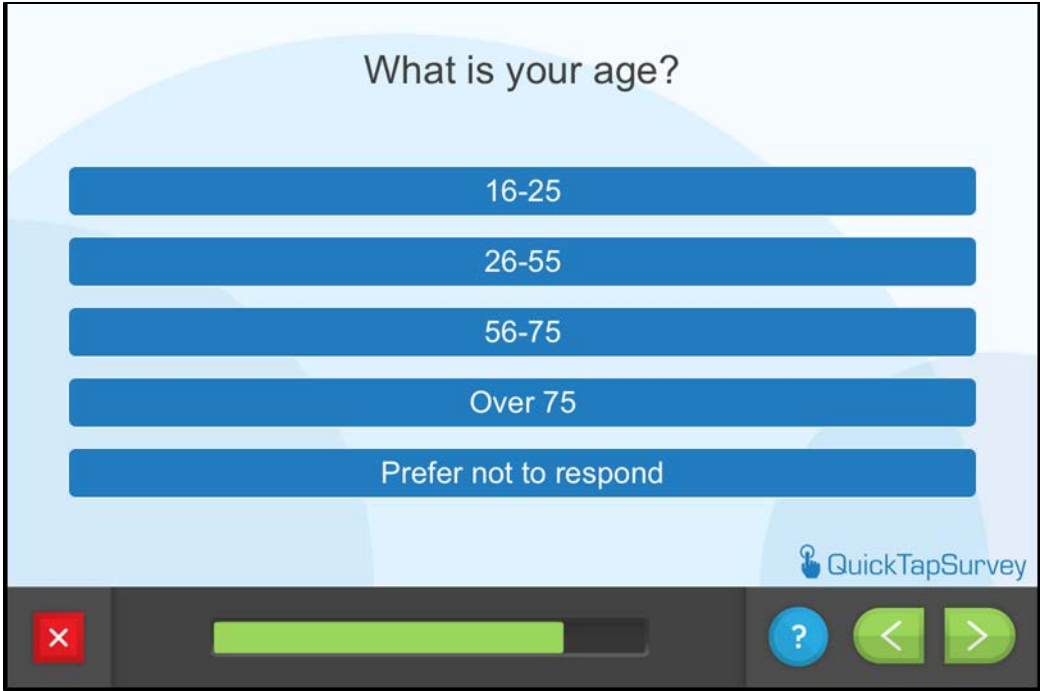
26-55

56-75

Over 75

Prefer not to respond

QuickTapSurvey

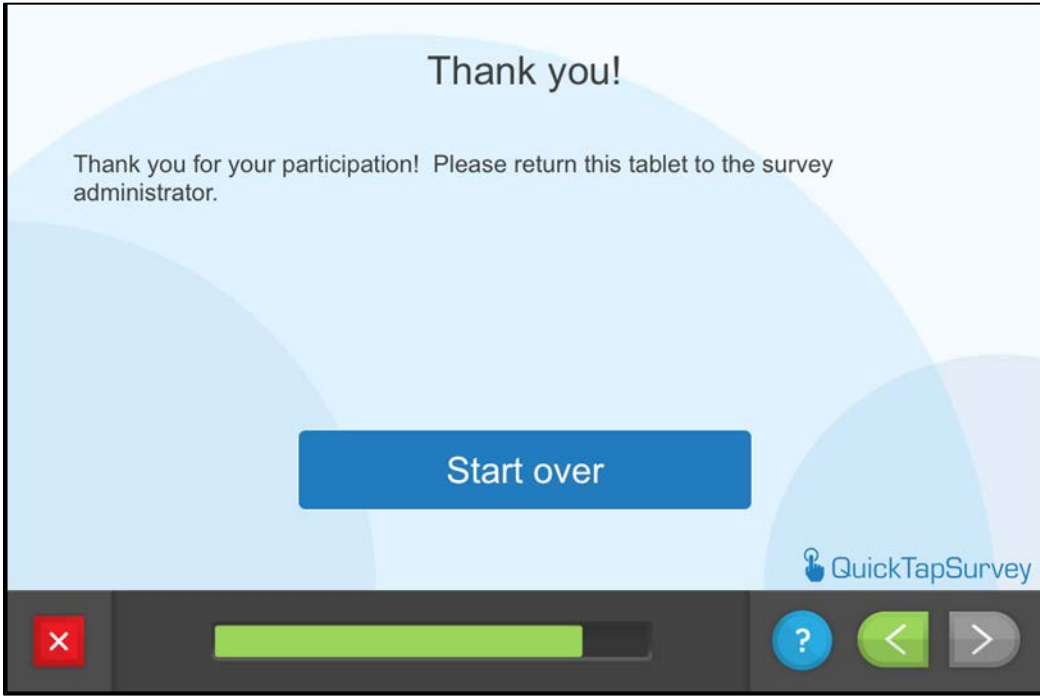


Thank you!

Thank you for your participation! Please return this tablet to the survey administrator.

Start over

QuickTapSurvey



MISSOURI, I-44

Screening question asked verbally: Did you happen to notice Electronic Messages Signs on I-44 like the one in the picture that have safety-related messages?



If eligible, main questionnaire given on an iPad:

Welcome

Thank you for agreeing to take this 3-5 minute survey. We respect your privacy: your participation is voluntary and anonymous. Your responses will help transportation agencies to better serve motorists like you.

IRB 0572-100052796

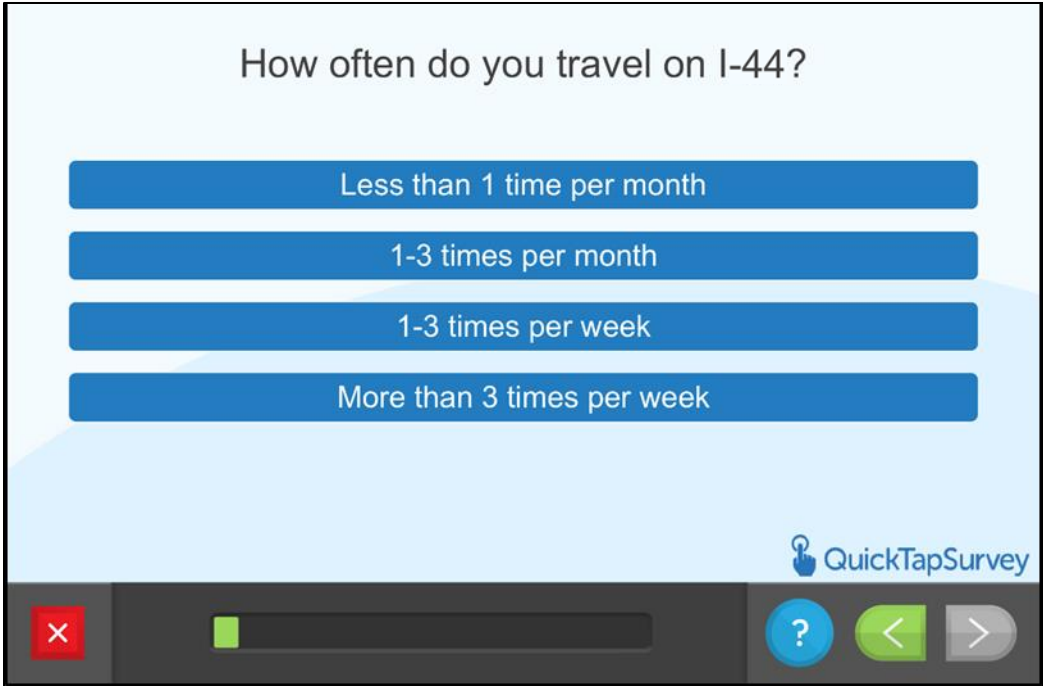
Begin

QuickTapSurvey

How often do you travel on I-44?

- Less than 1 time per month
- 1-3 times per month
- 1-3 times per week
- More than 3 times per week

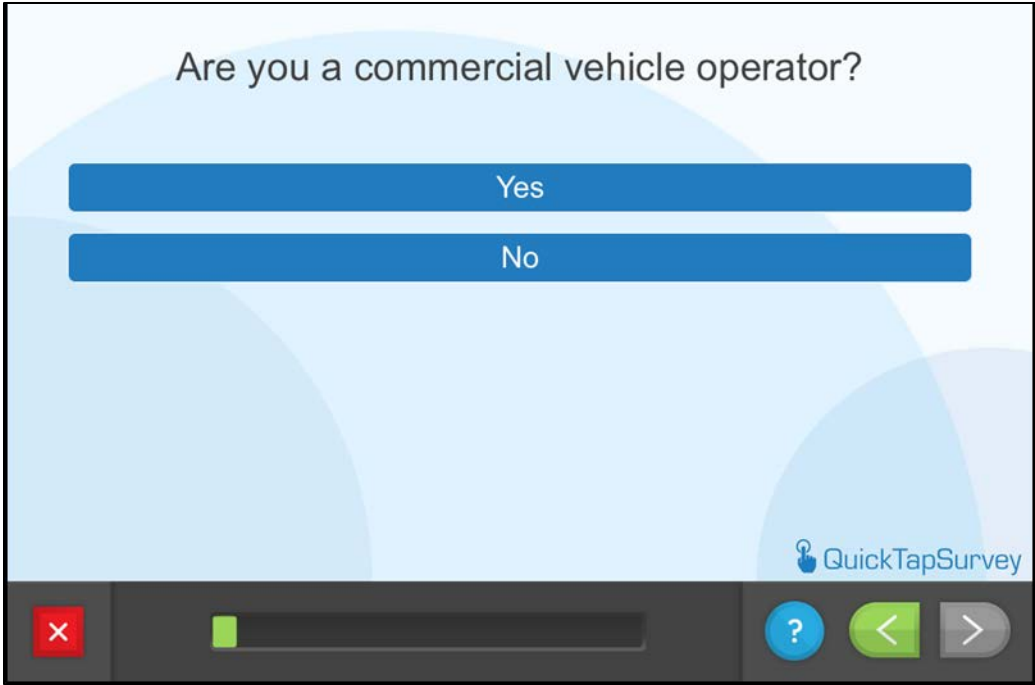
QuickTapSurvey



Are you a commercial vehicle operator?

- Yes
- No

QuickTapSurvey



Did you observe one of these safety-related messages on the Electronic Message Signs on I-44? (select all that apply)

Smoking Is Harmful To Your Health

Pass on Left, Drive on Right

It's a Passing Lane...Not a Cruising Lane

Changing Lanes? Show Me Your Blinker

Turn Signals...The Original Instant Message

Unbuckled? Seriously?

Buckle Up, Windshields Hurt

No, none of these

QuickTapSurvey



After seeing the message(s) did you do anything differently?

Yes

No

QuickTapSurvey

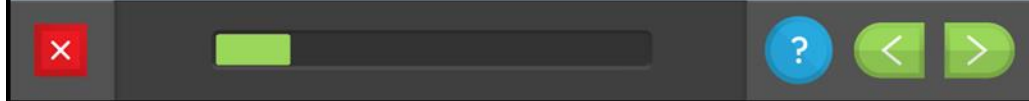


Follow-up question below, based on response. If yes:

What did you do? (select all that apply)

- Immediately change lanes out of passing lane
- Started using my turn signal when changing lanes
- Checked to see that I was wearing a seat belt
- Told my passenger to put on their seat belt
- Changed my driving behavior
- Other

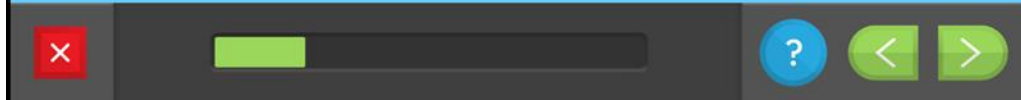
QuickTapSurvey



If no:

Why not? (select all that apply)

- I already use turn signals to change lanes
- I already move to the right lane after passing a vehicle
- I was already driving safely
- I did not understand the message
- Messages like this do not influence my decisions
- I do not know



About how often do you see safety campaign messages on these Dynamic Message Signs?

Less than 1 time per month

1-3 times per month

1-3 times per week

More than 3 times per week

QuickTapSurvey



(select all that apply) Have these Dynamic Message Signs ever:

Been difficult for you to read

Been hard to understand

Caused you to slow down in order to read the message

Caused other traffic to slow down to read the message

Do nothing

QuickTapSurvey



(select all that apply) Has seeing one of these Dynamic Message Signs ever caused you to:

<input type="checkbox"/> Slow down	<input type="checkbox"/> Put on your seat belt
<input type="checkbox"/> Ask passengers to put on a seat belt	<input type="checkbox"/> Be more attentive when driving
<input type="checkbox"/> Change your driving behavior	<input type="checkbox"/> Become distracted from driving
<input type="checkbox"/> Decide not to drive after drinking	<input type="checkbox"/> Do nothing differently

QuickTapSurvey

Navigation: [Close] [Progress] [Help] [Previous] [Next]

What does "It's a Passing Lane... Not a Cruising Lane" mean to you?

<input type="checkbox"/> Drivers should not use cruise control in the left lane
<input type="checkbox"/> Drivers should only drive in the left lane when passing a slower vehicle
<input type="checkbox"/> Police cruisers are prohibited from using the left lane
<input type="checkbox"/> I am not sure

Navigation: [Close] [Progress] [Help] [Previous] [Next]

Indicate your level of agreement with the following statements pertaining to the "It's a Passing Lane... Not a Cruising Lane" message

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It was understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was appropriate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It raised my awareness of the issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is displayed too often	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to stop reading message signs after seeing this message multiple times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

QuickTapSurvey

Are there any of these messages that you do NOT understand? (select all that apply)

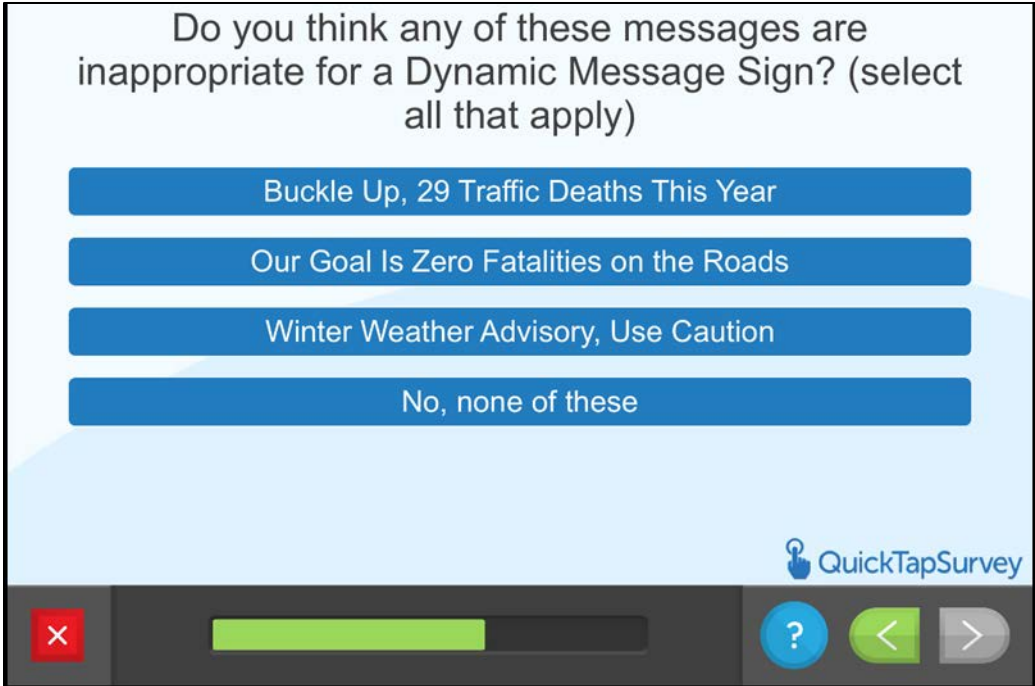
- Buckle Up, 29 Traffic Deaths This Year
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- I understand all of these

QuickTapSurvey

Do you think any of these messages are inappropriate for a Dynamic Message Sign? (select all that apply)

- Buckle Up, 29 Traffic Deaths This Year
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- No, none of these

QuickTapSurvey



Do any of these messages increase your awareness about an issue? (select all that apply)

- Buckle Up, 29 Traffic Deaths This Year
- Our Goal Is Zero Fatalities on the Roads
- Winter Weather Advisory, Use Caution
- No, none of these

QuickTapSurvey



Which way of communicating safety-related information do you think is best?

- Static roadside signs
- Dynamic message signs
- Radio/TV advertisements
- Printed advertisements (newspaper, magazine)
- Online advertisements or email

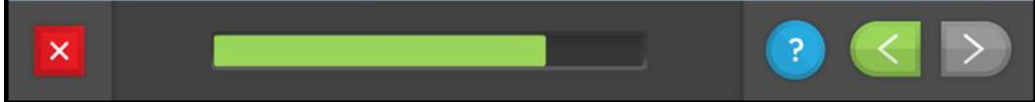
QuickTapSurvey



What types of messages do you think should be displayed on Dynamic Message Signs? (select all that apply)

- Traffic messages (congestion, travel time to a destination, accident)
- Safety-related messages (seat belts, distracted driving, work zone safety)
- Weather messages (severe storms, icy conditions, windy conditions)
- Missing person messages (AMBER alert, silver alert)
- Other messages (call 511, special event notice, ozone action day)

QuickTapSurvey



What is your age?

16-25

26-55

56-75

Over 75

Prefer not to respond

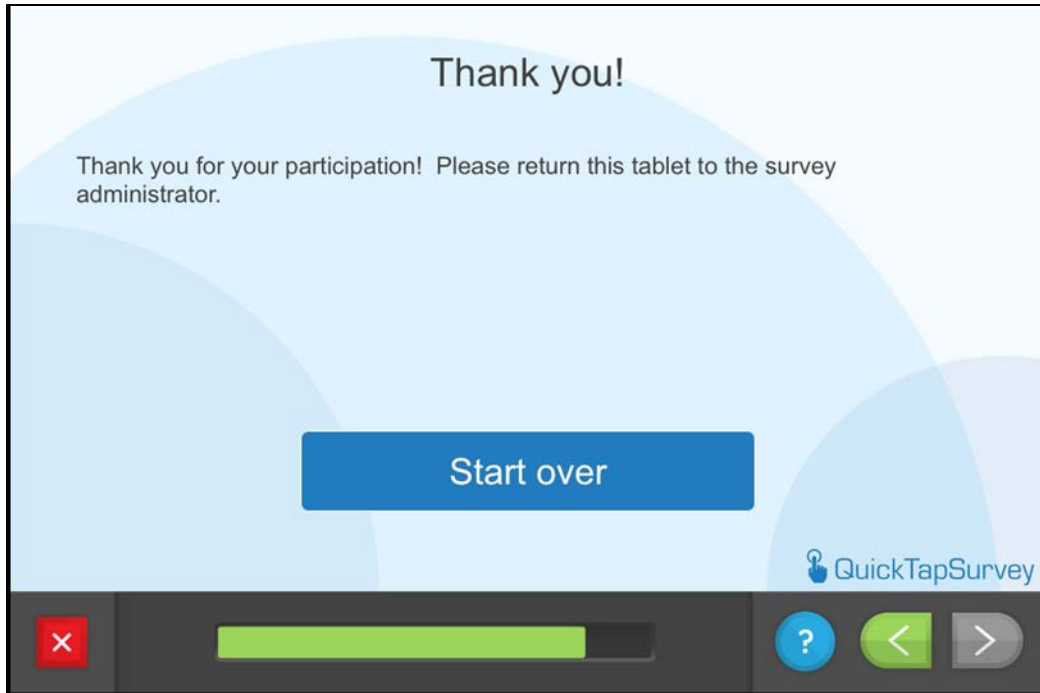
QuickTapSurvey

What is your sex?

Female

Male

QuickTapSurvey

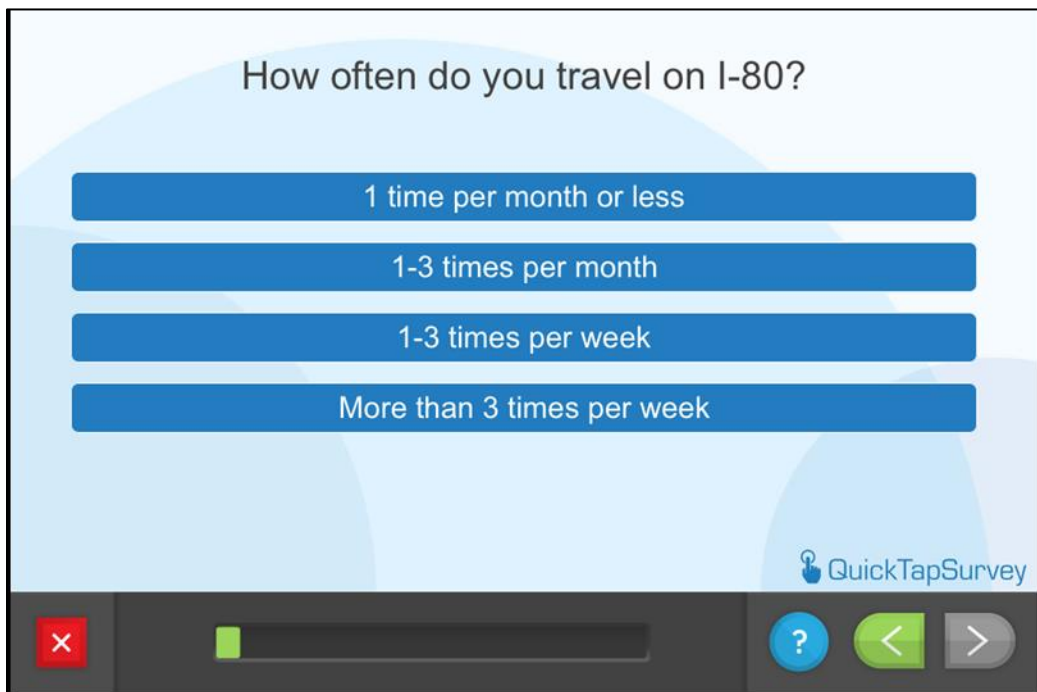
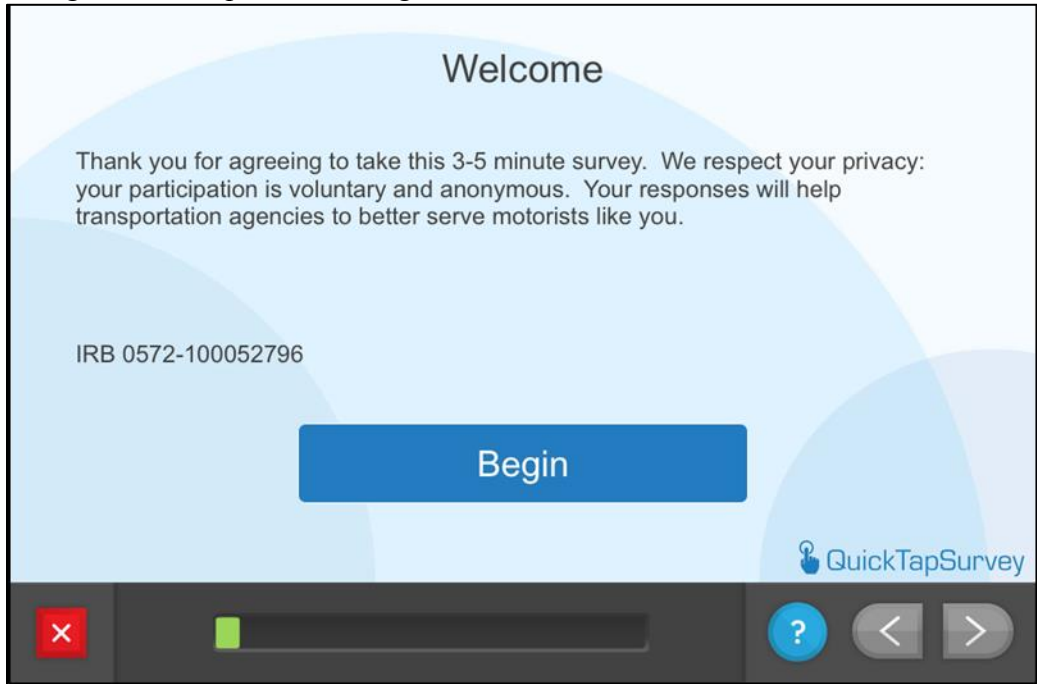


NEVADA, I-80

Screening question asked verbally: Did you happen to notice Dynamic Messages Signs on I-80 like the one in the picture that have safety-related messages?



If eligible, main questionnaire given on an iPad:



Are you a commercial vehicle operator?

Yes

No

QuickTapSurvey



Did you observe one of these safety-related message on the Dynamic Message Signs on I-80? (select all that apply)



Smoking is Harmful to Your Health



Drive Safely Make It Zero Fatalities



Our Goal Is Zero Fatalities on Nevada Roads

No, none of these

No, none of these

QuickTapSurvey

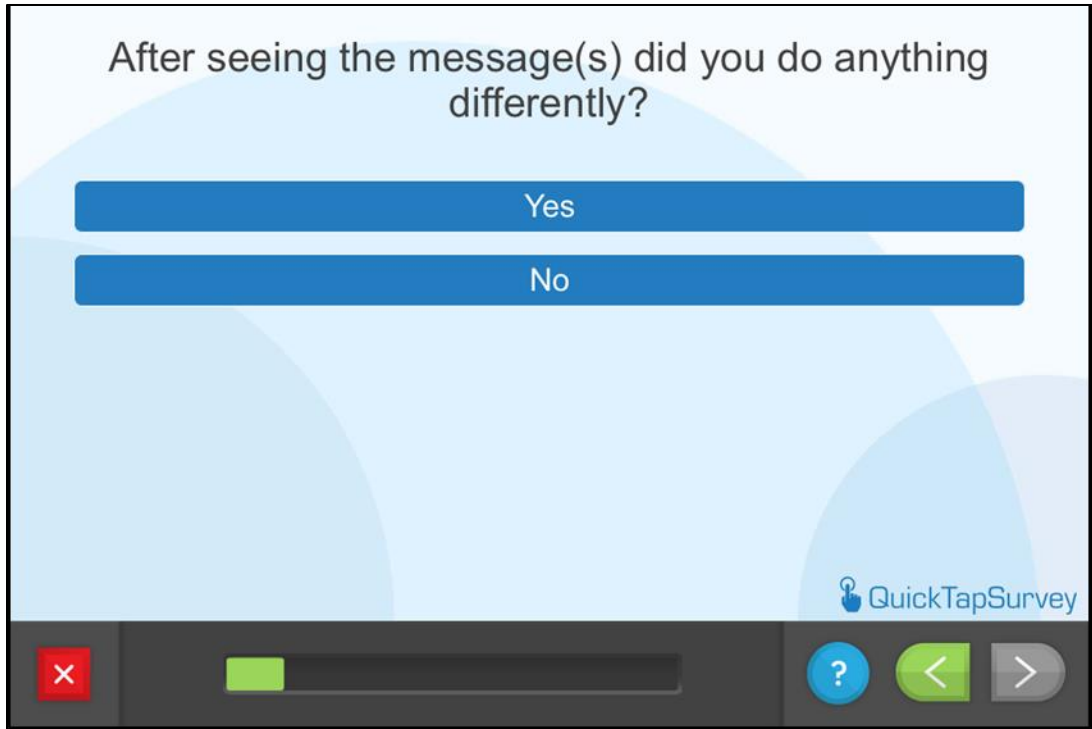


After seeing the message(s) did you do anything differently?

Yes

No

QuickTapSurvey



Follow-up question below, based on response. If yes:

What did you do? (select all that apply)

Slowed down

Be more attentive when driving

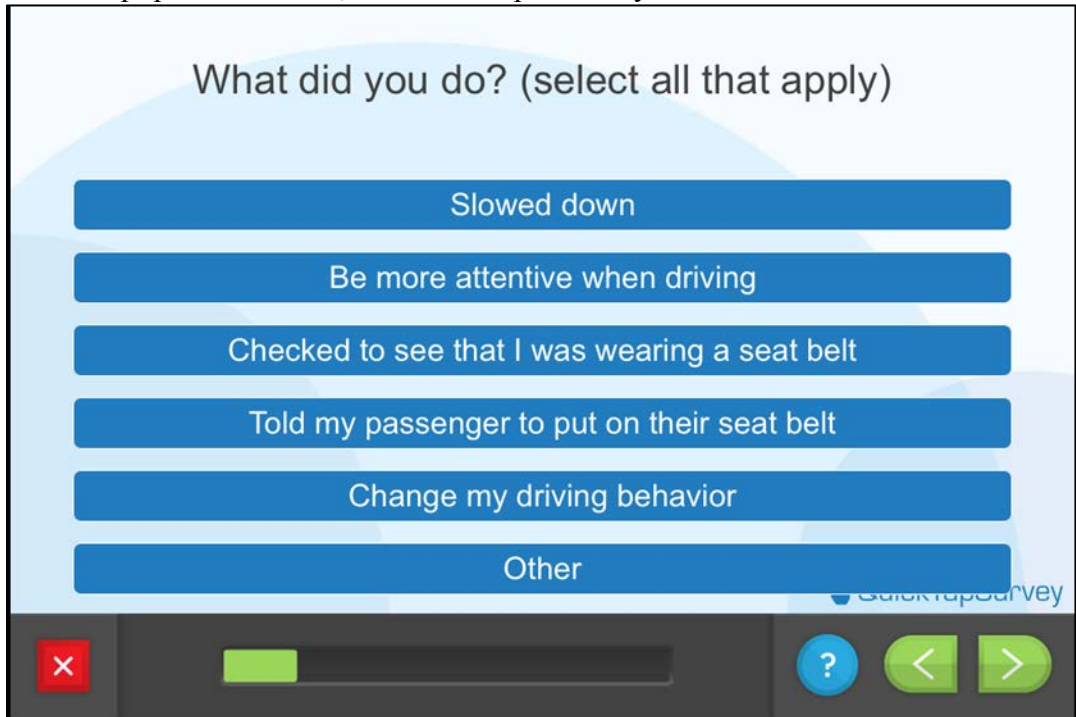
Checked to see that I was wearing a seat belt

Told my passenger to put on their seat belt

Change my driving behavior

Other

QuickTapSurvey

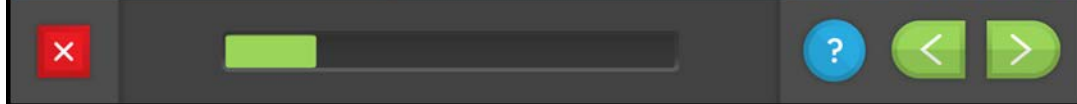


If no:

Why not? (select all that apply)

- I was already driving safely
- I did not understand the message
- Messages like this do not influence my decisions
- I have not seen police pulling people over in this area
- I do not know

QuickTapSurvey



About how often do you see safety campaign messages on these Dynamic Message Signs?

- Less than 1 time per month
- 1-3 times per month
- 1-3 times per week
- More than 3 times per week

QuickTapSurvey



(select all that apply) Have these Dynamic Message Signs ever:

Been difficult for you to read

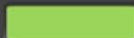
Been hard to understand

Caused you to slow down in order to read the message

Caused other traffic to slow down to read the message

Do nothing

QuickTapSurvey



(select all that apply) Has seeing one of these Dynamic Message Signs ever caused you to:

Slow down

Put on your seat belt

Ask passengers to put on a seat belt

Be more attentive when driving

Change your driving behavior

Become distracted from driving

Decide not to drive after drinking

Do nothing differently

QuickTapSurvey



What does "Our Goal is Zero Fatalities On Nevada Roads" mean to you?

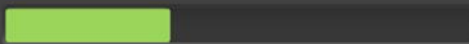
Nevada wants you to drive safely to prevent fatal crashes

Nevada is trying to reduce on-the-job employee deaths

Nevada is trying to reduce vehicle-animal strikes on roads

I am not sure

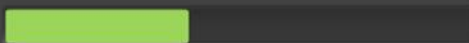
QuickTapSurvey



Indicate your level of agreement with the following statements pertaining to the "Our Goal is Zero Fatalities on Nevada Roads" message

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It was understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was appropriate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It raised my awareness of the issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is displayed too often	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to stop reading message signs after seeing this message multiple times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

QuickTapSurvey



Are there any of these messages that you do NOT understand? (select all that apply)



Move Over for Police and Highway Workers



Buckle Up, 29 Traffic Deaths This Year



Winter Weather Advisory, Use Caution

I understand all of them

I understand all of them

QuickTapSurvey



Do you think any of these messages are inappropriate for a Dynamic Message Sign? (select all that apply)



Move Over for Police and Highway Workers



Buckle Up, 29 Traffic Deaths This Year

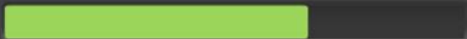


Winter Weather Advisory, Use Caution

No, none of these

No, none of these

QuickTapSurvey



Do any of these messages increase your awareness about an issue? (select all that apply)



Move Over for Police and Highway Workers



Buckle Up, 29 Traffic Deaths This Year



Winter Weather Advisory, Use Caution

No, none of these

No, none of these

QuickTapSurvey



Which way of communicating safety-related information do you think is best?

Static roadside signs

Dynamic message signs

Radio/TV advertisements

Printed advertisements (newspaper, magazine)

Online advertisements or email

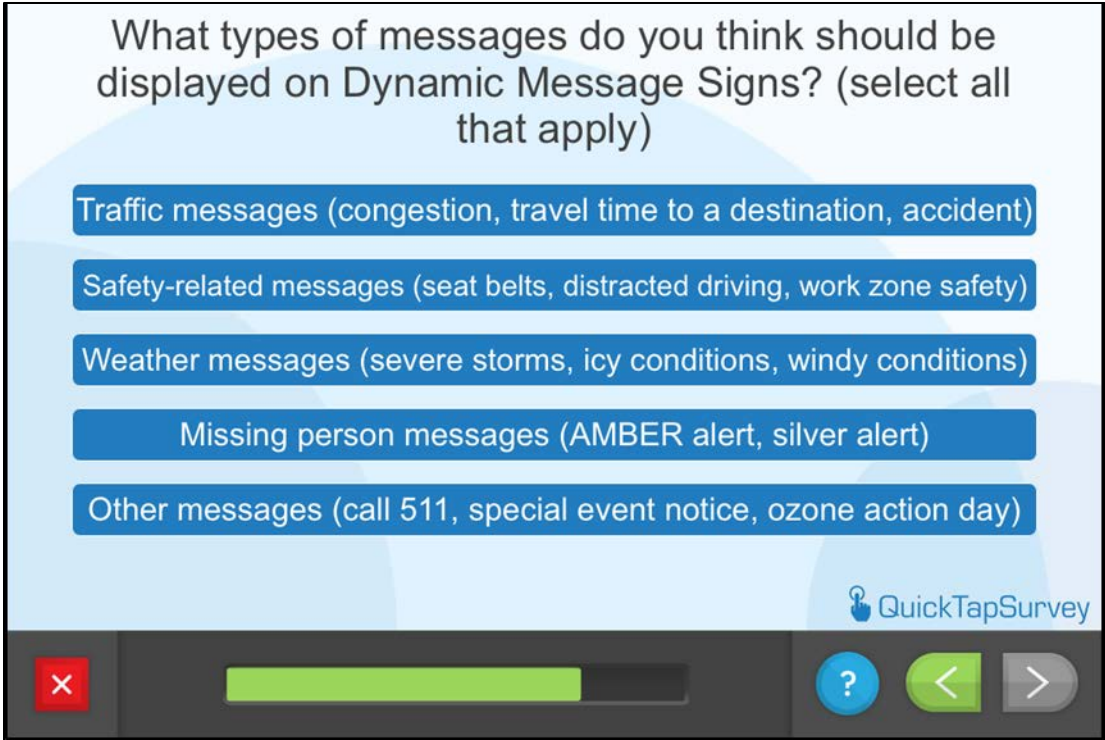
QuickTapSurvey



What types of messages do you think should be displayed on Dynamic Message Signs? (select all that apply)

- Traffic messages (congestion, travel time to a destination, accident)
- Safety-related messages (seat belts, distracted driving, work zone safety)
- Weather messages (severe storms, icy conditions, windy conditions)
- Missing person messages (AMBER alert, silver alert)
- Other messages (call 511, special event notice, ozone action day)

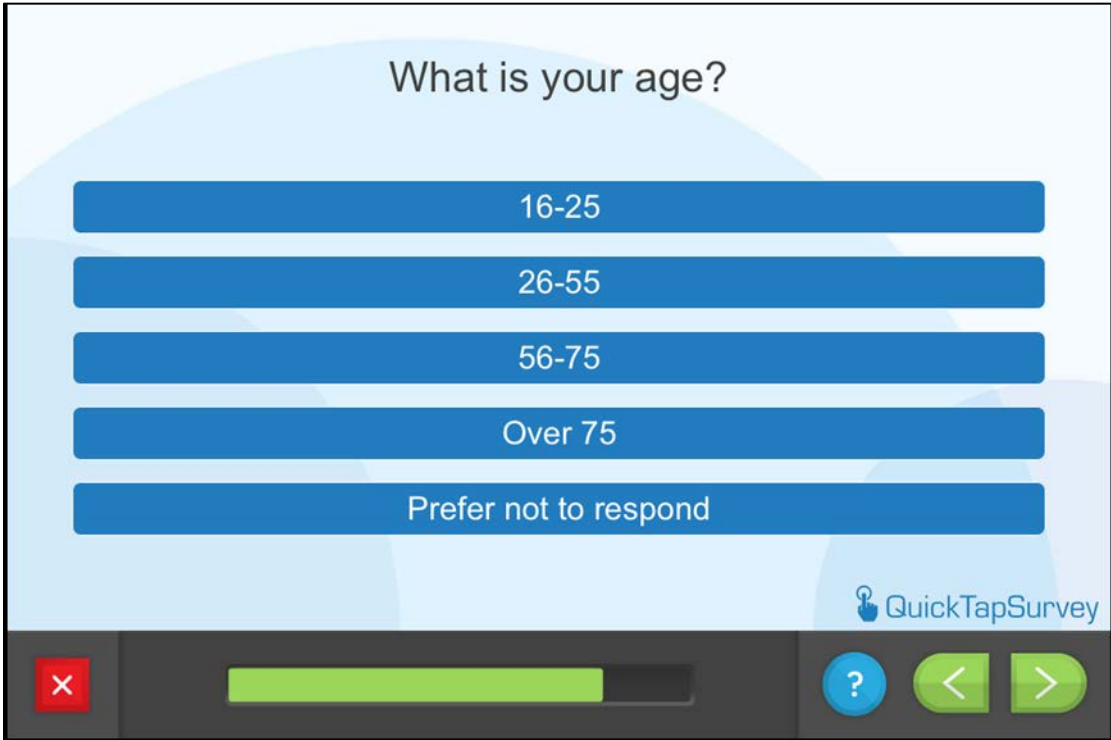
QuickTapSurvey



What is your age?

- 16-25
- 26-55
- 56-75
- Over 75
- Prefer not to respond

QuickTapSurvey



Thank you!

Thank you for your participation! Please return this tablet to the survey administrator.

Start over

 QuickTapSurvey



APPENDIX B – COMMENTS FROM SURVEY PARTICIPANTS

This section includes any comments received from participants that completed the survey, organized by the corridor in which they were provided. The survey teams did not log casual remarks received from individuals who were either ineligible to take the survey or were eligible and refused to take the survey.

KANSAS, I-70

Messages survey participants like:

- Weather (e.g., ice and tornados).
- Weather-related messages.
- Weather advisories, including winter weather and thunderstorms for drivers to pull off.
- Weather messages about tornado alerts and winter weather.
- Messages about major backups.
- “Stay on Right, Pass on Left” (i.e., drive on right unless passing) (2 responses).
- Motorcycle awareness (2 responses).
- Motorcycle safety.
- Truck awareness.
- “Slow Down Champ, This Isn’t a Race”.
- “Keep Both Hands on the Wheel”.
- Likes the funny signs in Missouri.
- Catchy messages are great.
- Catchy messages like “Drive Hammered, Get Nailed” and “Hit a Worker, \$10,000 fine”.
- Hitting a construction worker is a \$10,000 fine.
- Get message out about cell phone use, e.g., “Hands-free use required for mobile devices”.
- Seat belt and work zone messages displayed in Missouri; they make me pay attention.
- Messages displayed in Colorado are good (note: did not identify any specific message).
- For truckers, messages saying what lane to be in for a work zone lane closure and distance to the work zone.
- For truckers, accident ahead signs helpful so trucks can divert in advance with enough notice.
- Colorado has good weather warning signs, which would be nice to have in Kansas.
- Pull over if you’re sleepy.
- Travel time, congestion, specific alternate routes to use.
- Congestion and travel time signs.
- Queue warning messages.
- AMBER alerts.
- Aggressive driving messages – tailgating, speeding, left lane for passing only.
- Evacuation warning messages to give truckers advance warning to turn around or divert.
- Seat belt messages.
- Messages about texting.
- “Do Not Throw Cigarettes Out the Window”.

- Who to call for an emergency, if not 911.
- “Wipers On, Lights On”.

Other comments included:

- DMS are used too often, but good for major things.
- Why show a message about workers if there are no highway workers present?
- A consistent phone number for the highway patrol in all states would be nice.

MINNESOTA/WISCONSIN, I-94

- If drivers are required to wear seatbelts, motorcyclists should be required to wear helmets.
- Need a “Don’t annoy the wife” message.
- Minnesota/Wisconsin should indicate when weigh stations are open or closed with signage on the road to help truck drivers save time.
- Like the message “if you die while driving distracted, you’ll never do it again”.
- People do read the messages about highway fatalities and it makes you think when you see that the number has gone up.
- Post “take alternate route” or the actual diversion route when there is a major crash.
- Death toll signs are eye-opening.
- Better design makes the sign more appealing.
- The only messages I respond to are about construction information.
- I don’t think there should be signs saying the number of deaths – no one wants to know that.
- I don’t like these signs. The signs telling you about traffic congestion aren’t soon enough. People slow down to read them and it makes traffic worse.
- Would prefer exit numbers instead of mile numbers for messages about accidents and congestion.
- I do not like electronic billboards that flash too quickly to read because then you’re trying to look back to see what they said.
- Truck drivers don’t wear seat belts because they have to lean forward constantly to check the large blind spots.
- I avoid reading the signs because I don’t want to see the death toll numbers.
- I wish the no texting laws would be enforced.
- Need more do not text signs – there are so many people texting.
- Add more signs.
- The signs are distracting and cause fatalities.

MISSOURI, I-44

- Consider adding flashing lights to DMS.
- Does the 67 percent of fatalities unbuckled statistic include pedestrian and motorcycle fatalities?
- Messages in Tennessee were hard to read.
- Like the message “Give truckers room because they cannot stop on a dime, but they can stop on other vehicles”.

- Need more enforcement of pass/cruise for the left lane and speed limits, posting messages is not enough.
- Electronic message signs are the best way to reach drivers with disabilities.
- The message “Passing lane is not a cruising lane” implies you should be speeding.
- Listing the number of traffic deaths is good.
- The signs are very helpful, especially for weather and traffic information which makes the trip much easier.
- Tax dollars should be spent on road repair instead of paying people to take surveys.
- A message should say “No Tailgating”.
- A message should say “Don’t Text and Drive”.
- Think DMS should be used more for AMBER alerts and traffic conditions.
- Buckle Up, 29 Deaths This Year can be confusing.
- Truck drivers should be allowed to advertise these messages on the side of their trucks.

NEVADA, I-80

- Liked the Fernley DMS because it is not in your face or distracting.
- DMS messages are very distracting because they do not apply to me.
- Motorcycle awareness messages are needed as the weather improves.
- Truckers are not always right – when side-by-side to block passers, it causes frustrated drivers, i.e., unsafe drivers; a DMS message somewhere said to respect truckers, but truckers are not always right.
- Awareness of no-passing zones is a major issue.
- Messages should pertain to driving, e.g., not drought.
- AMBER alerts are ok, but any other message is a waste of money.
- Tear DMS down, they are a waste of taxpayer money.
- Take the DMS down because they cause traffic problems when drivers slow down to read them.
- Tear all the DMS down and text people the message instead; the signs are a waste of money, but people pay attention to their phones while driving.
- Spend less on signs and fix the roads; having too many signs is more distracting than texting is.
- Liked “Drive hammered, get nailed” message.
- Have seen the motorcycle awareness messages (5+ responses).
- Really like the travel time signs.
- Truck/trailer speed should be lower in Nevada; it is 55 mph in California.
- Winter weather messages are great.
- DMS messages are good and they help.
- Definitely keep up the AMBER alert messages.
- Travel time messages are not important.
- Like messages about weather and construction.
- Good highway patrol in Nevada; they pull over cars and not just trucks.
- Cell phone use is a major issue, which is a reason why many drivers probably do not see the signs.

APPENDIX C – ODDS RATIO GRAPHS FOR EVALUATION OF HYPOTHESES

This section includes graphs of odds ratios for each site from the evaluation of select hypotheses. Figure C-1 through Figure C-4 present the odd ratios for each study corridor for the awareness hypothesis of observing an actual safety message and/or PSA on a DMS.

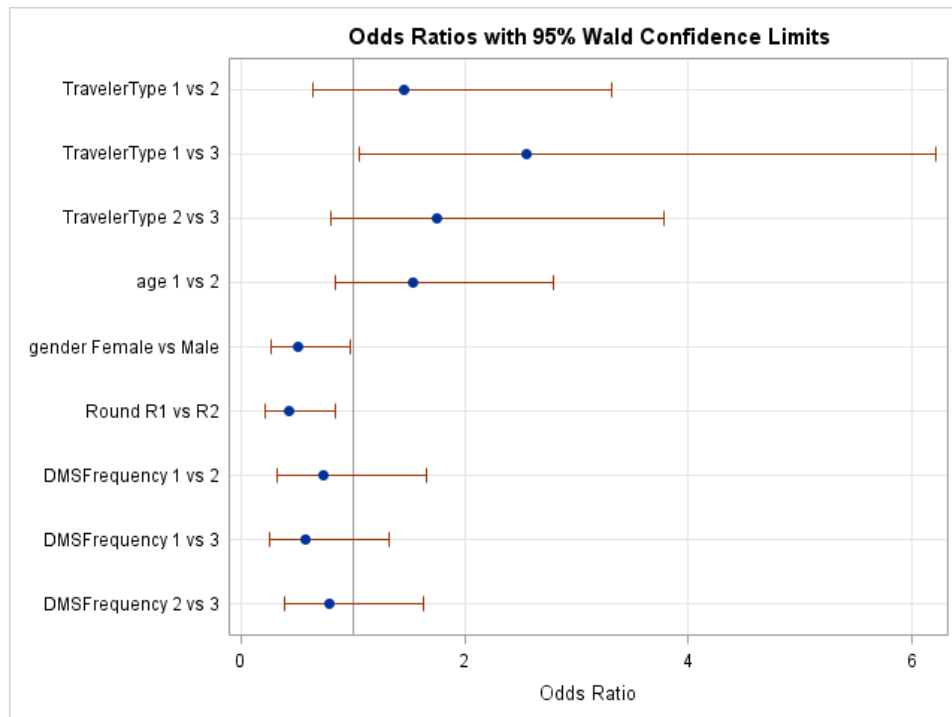


Figure C-1. Graph. Odds Ratios with 95 Percent Confidence Limits – Awareness Hypothesis of Observing an Actual Safety Message and/or PSA on a DMS in Nevada.

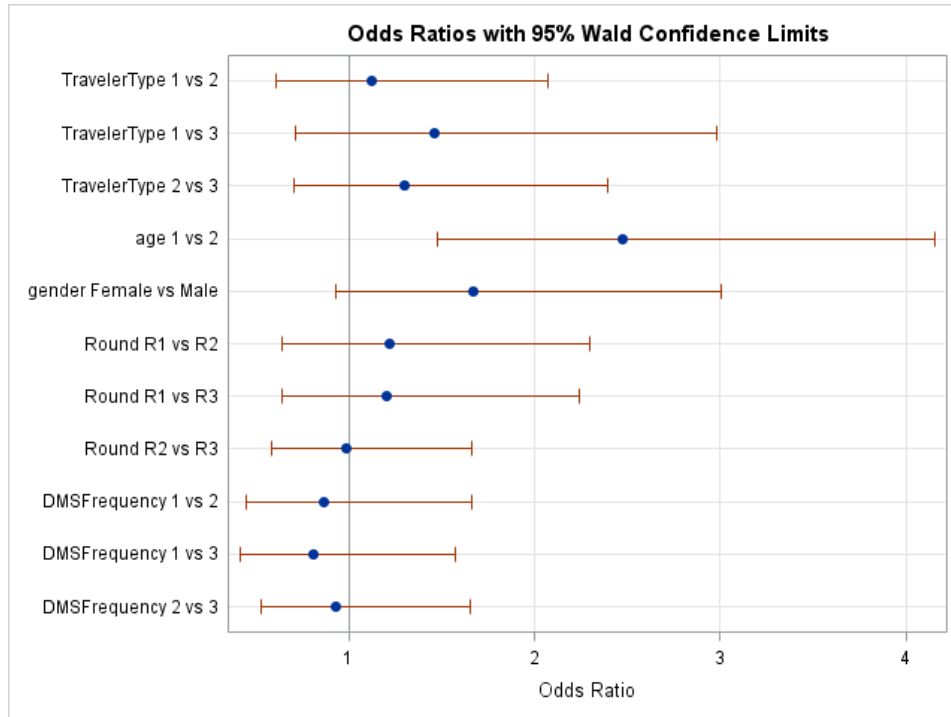


Figure C-2. Graph. Odds Ratios with 95 Percent Confidence Limits – Awareness Hypothesis of Observing an Actual Safety Message and/or PSA on a DMS in Minnesota/Wisconsin.

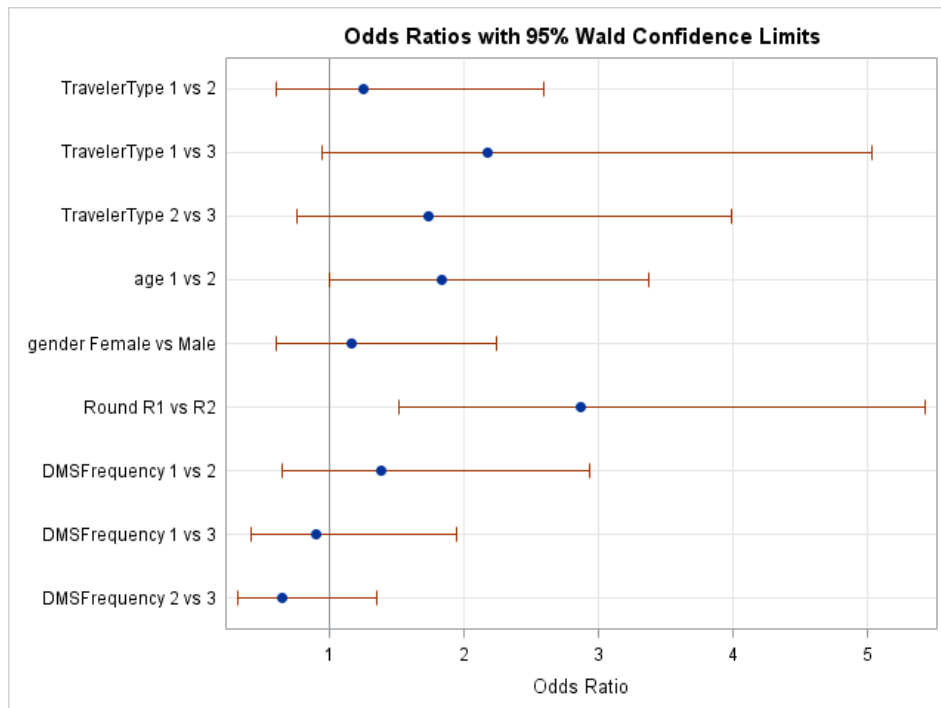


Figure C-3. Graph. Odds Ratios with 95 Percent Confidence Limits – Awareness Hypothesis of Observing an Actual Safety Message and/or PSA on a DMS in Kansas.

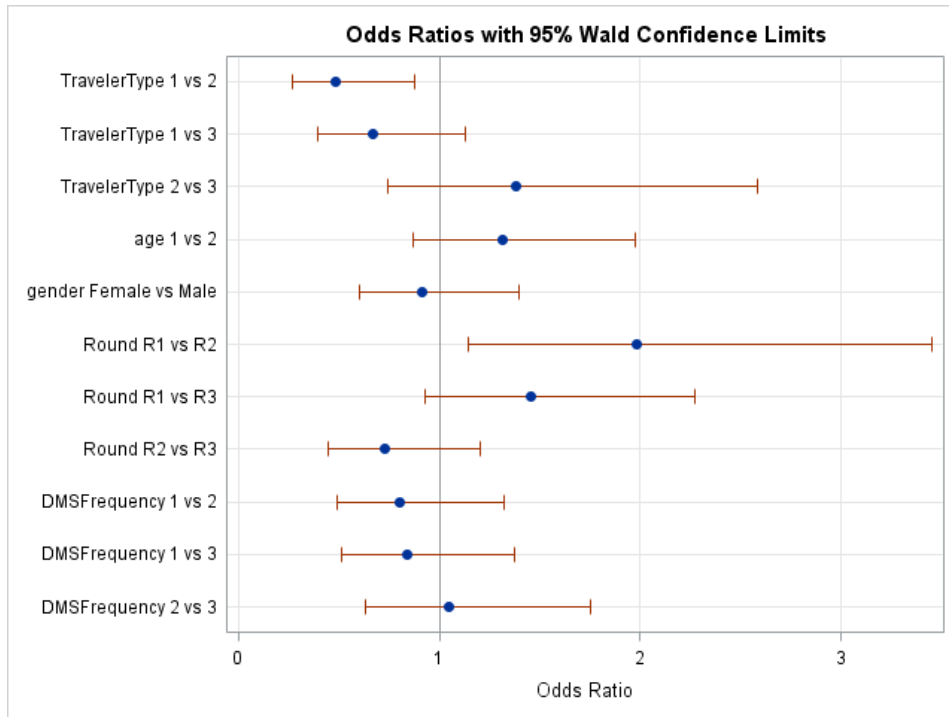


Figure C-4. Graph. Odds Ratios with 95 Percent Confidence Limits – Awareness Hypothesis of Observing an Actual Safety Message and/or PSA on a DMS in Missouri.

Figure C-5 through Figure C-8 present the odd ratios for each study corridor for the understanding hypothesis on travelers understanding the listed message.

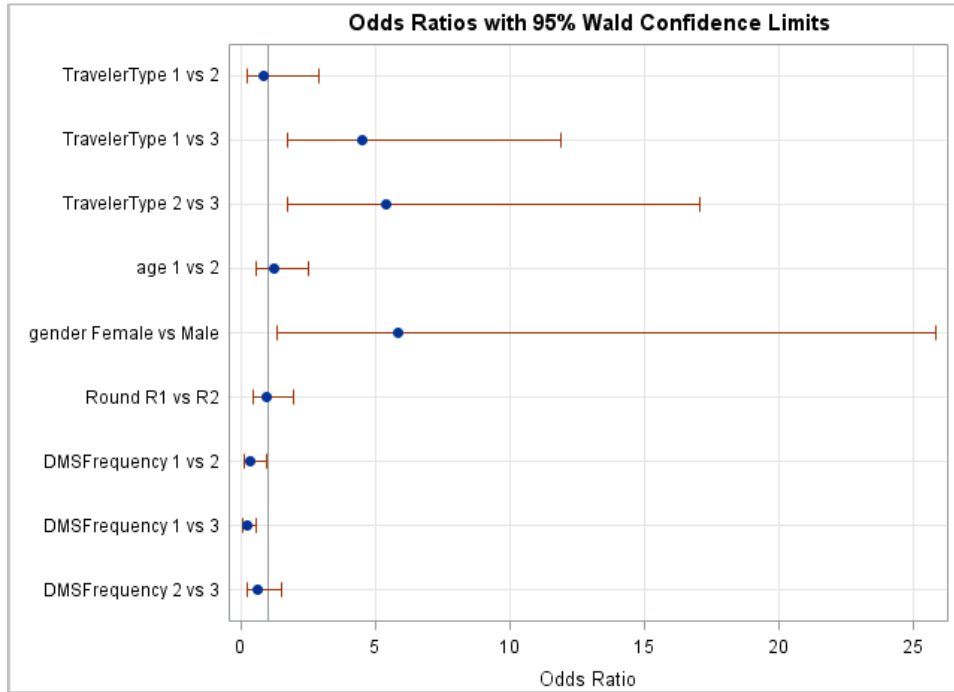


Figure C-5. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Understanding of the Listed Message in Nevada.

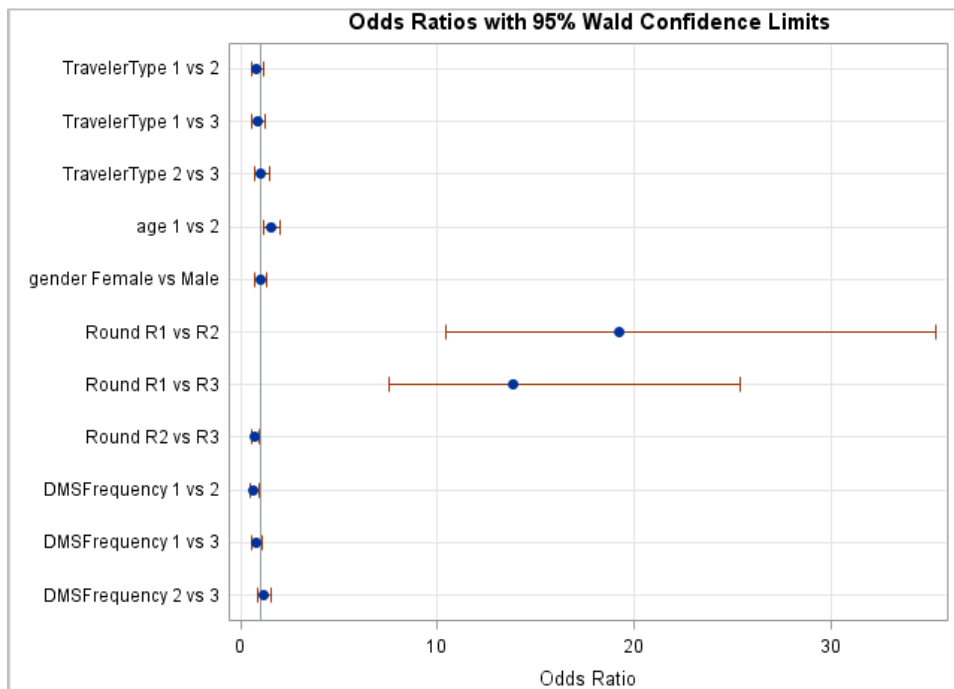


Figure C-6. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Understanding of the Listed Message in Minnesota/Wisconsin.

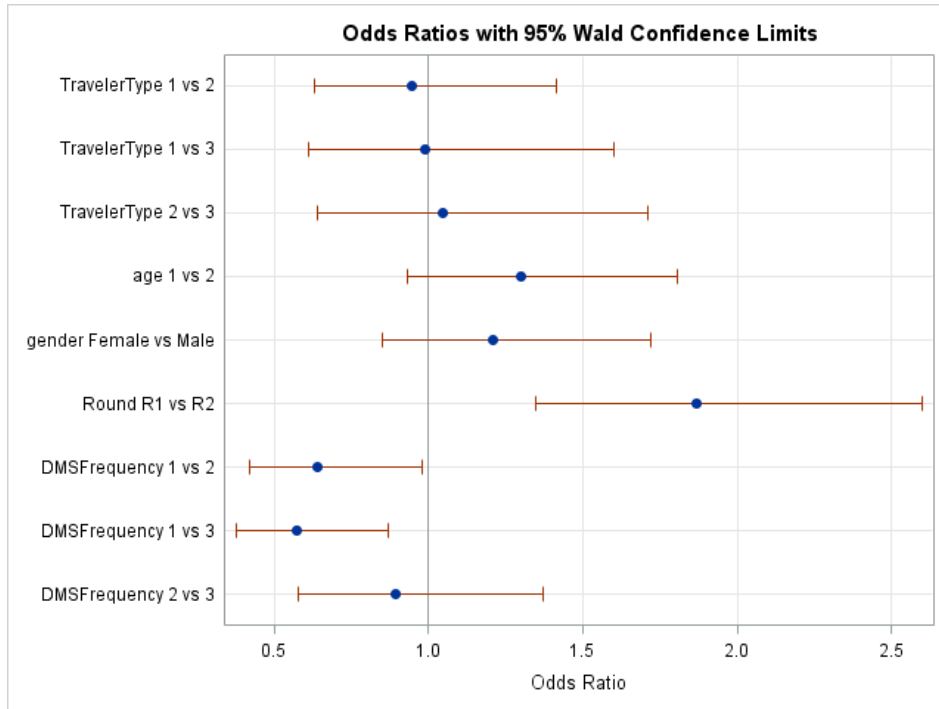


Figure C-7. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Understanding of the Listed Message in Kansas.

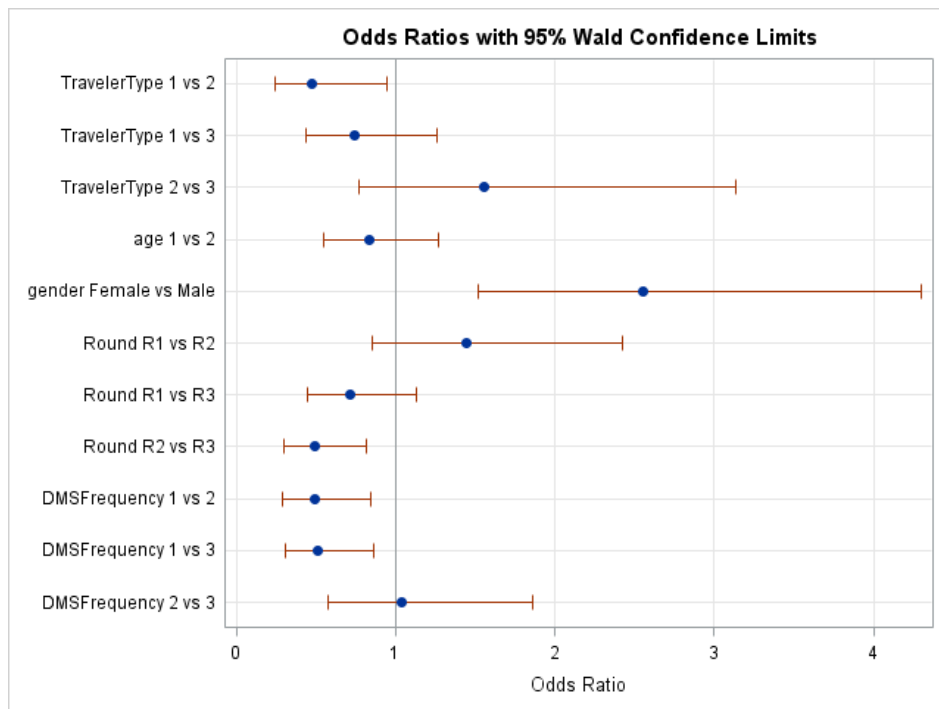


Figure C-8. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Understanding of the Listed Message in Missouri.

Figure C-9 through Figure C-12 present the odd ratios for each study corridor for the understanding hypothesis on whether the message is understandable.

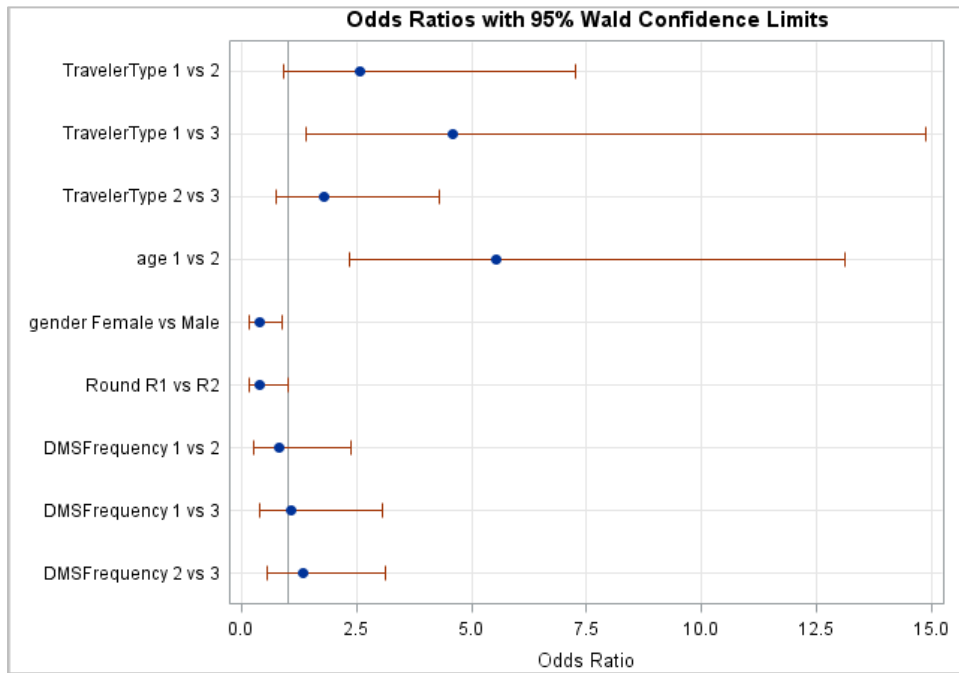


Figure C-9. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Whether the Message is Understandable in Nevada.

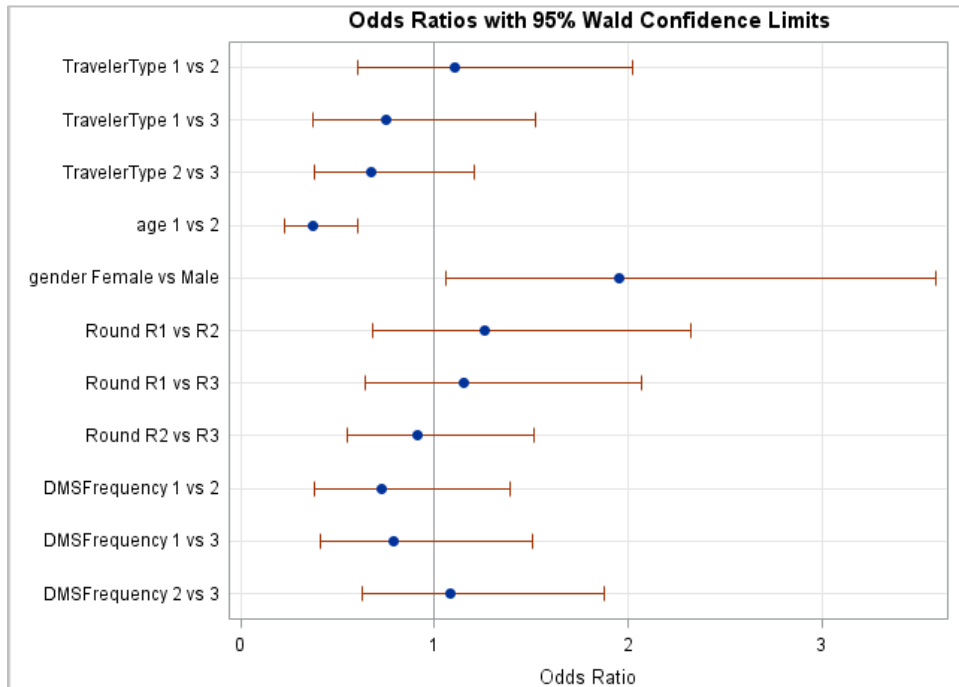


Figure C-10. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Whether the Message is Understandable in Minnesota/Wisconsin.

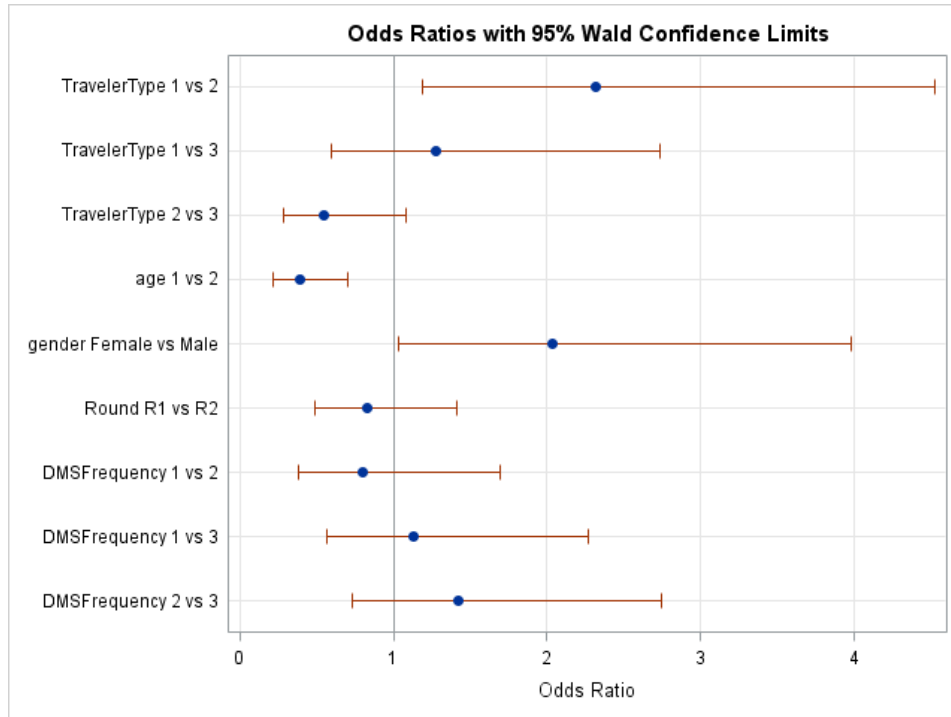


Figure C-11. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Whether the Message is Understandable in Kansas.



Figure C-12. Graph. Odds Ratios with 95 Percent Confidence Limits – Understanding Hypothesis on Whether the Message is Understandable in Missouri.

Figure C-13 through Figure C-16 present the odd ratios for each study corridor for the behavior hypothesis on whether safety-related DMS cause drivers to slow down.

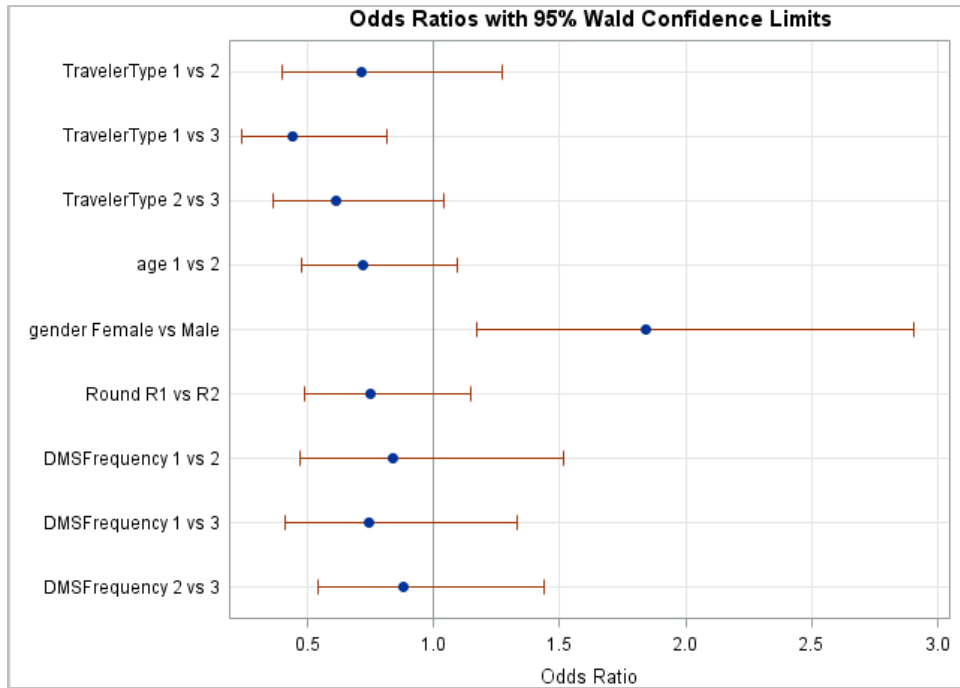


Figure C-13. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on whether Safety-Related DMS Cause Drivers to Slow Down in Nevada.

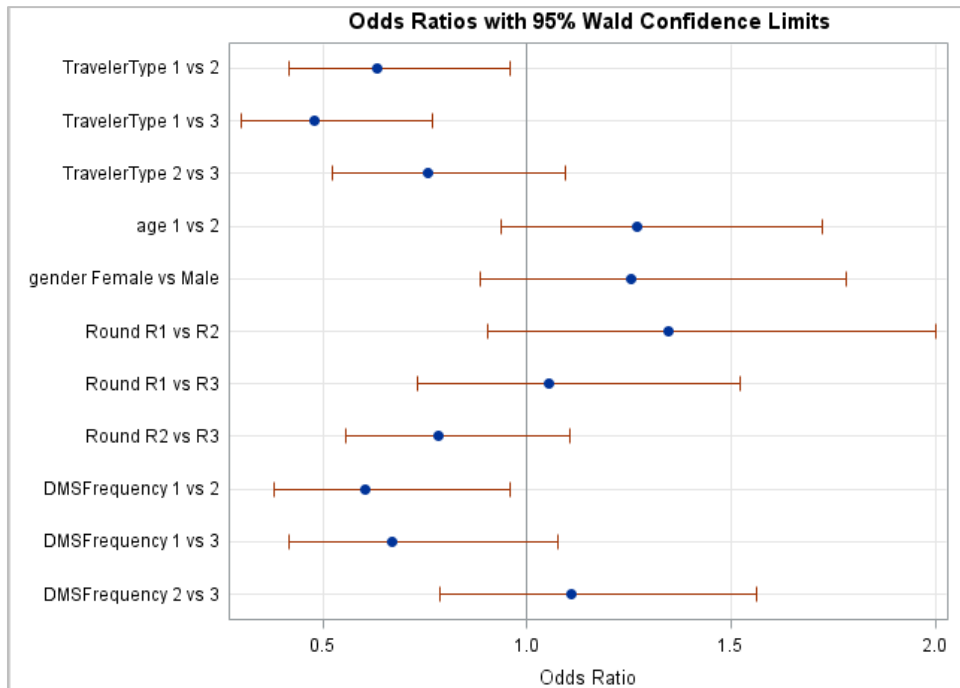


Figure C-14. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on whether Safety-Related DMS Cause Drivers to Slow Down in Minnesota/Wisconsin.

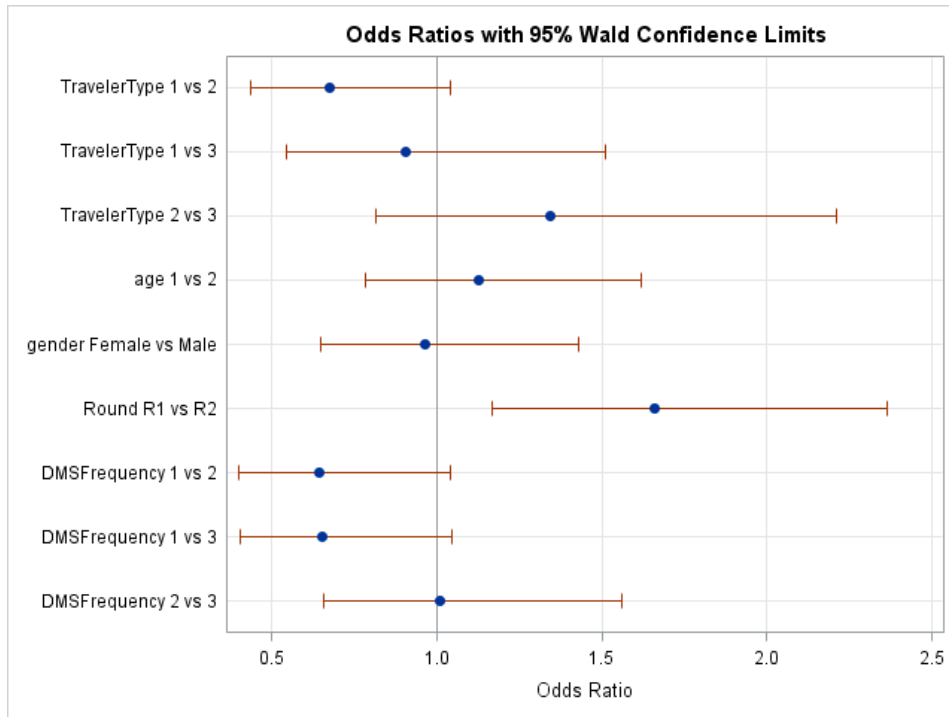


Figure C-15. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on whether Safety-Related DMS Cause Drivers to Slow Down in Kansas.



Figure C-16. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on whether Safety-Related DMS Cause Drivers to Slow Down in Missouri.

Figure C-17 through Figure C-20 present the odd ratios for each study corridor for the behavior hypothesis on whether travelers do anything differently after seeing the safety or PSA message.

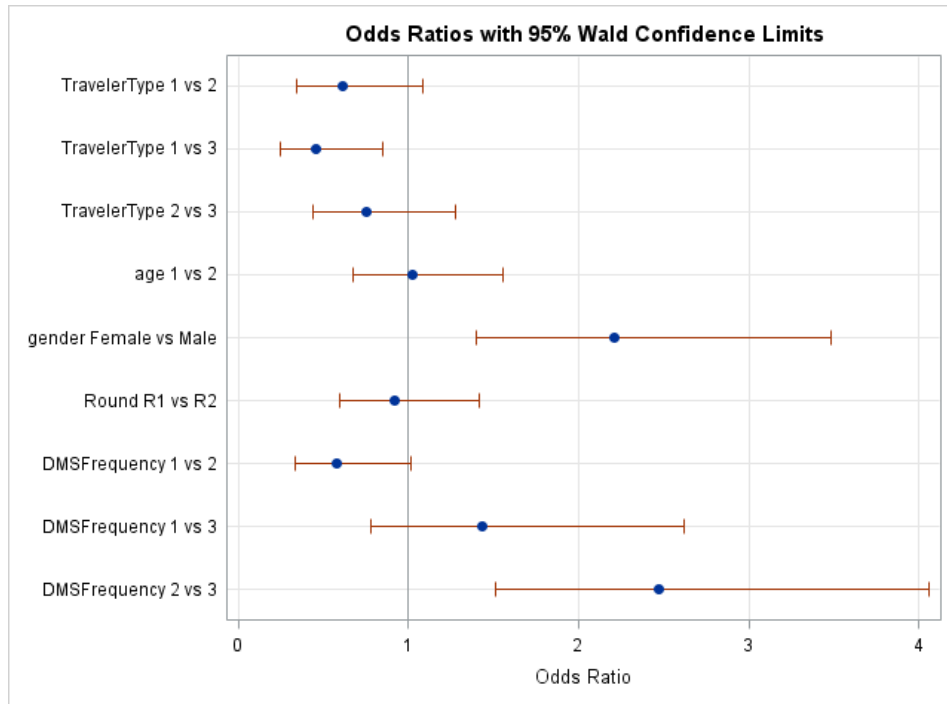


Figure C-17. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Doing Anything Differently after Seeing the Message in Nevada.

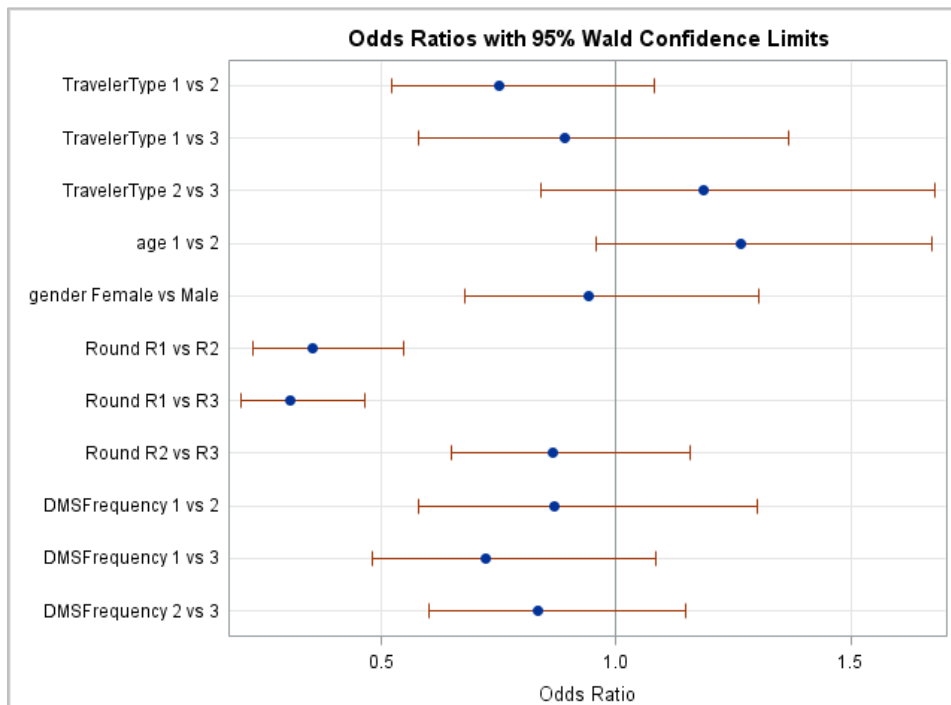


Figure C-18. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Doing Anything Differently after Seeing the Message in Minnesota/Wisconsin.

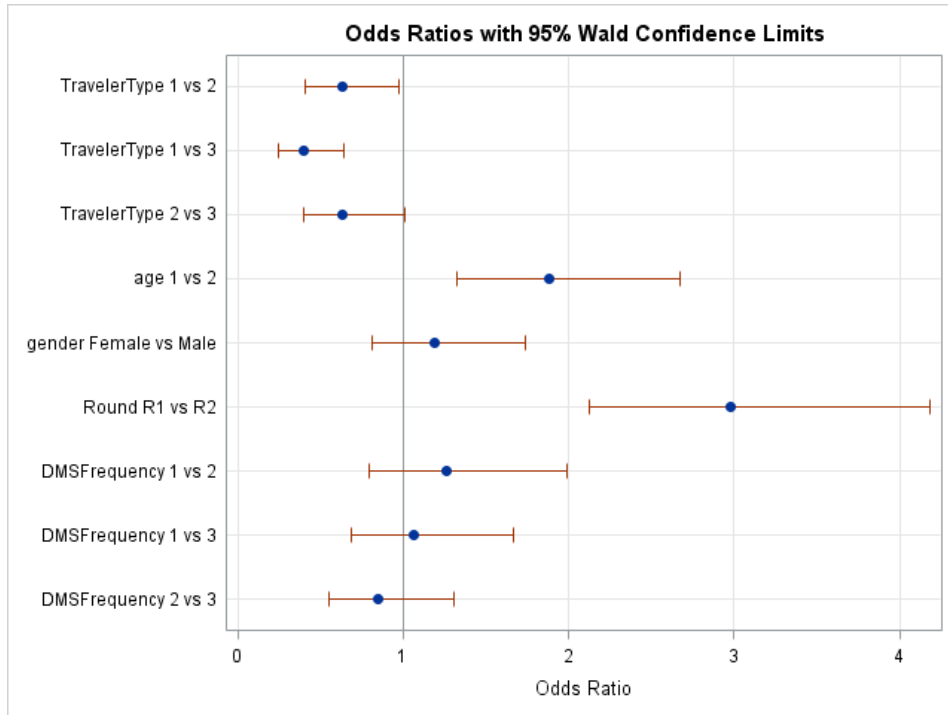


Figure C-19. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Doing Anything Differently after Seeing the Message in Kansas.

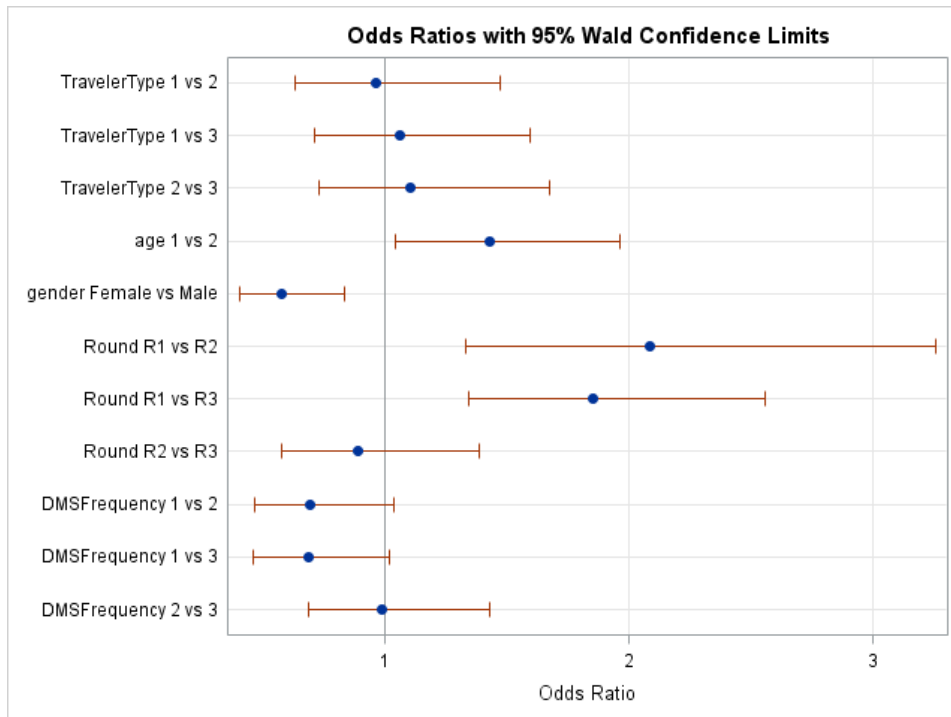


Figure C-20. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Doing Anything Differently after Seeing the Message in Missouri.

Figure C-21 through Figure C-24 present the odd ratios for each study corridor for the behavior hypothesis on whether safety-related DMS messages cause changes in driving behavior.

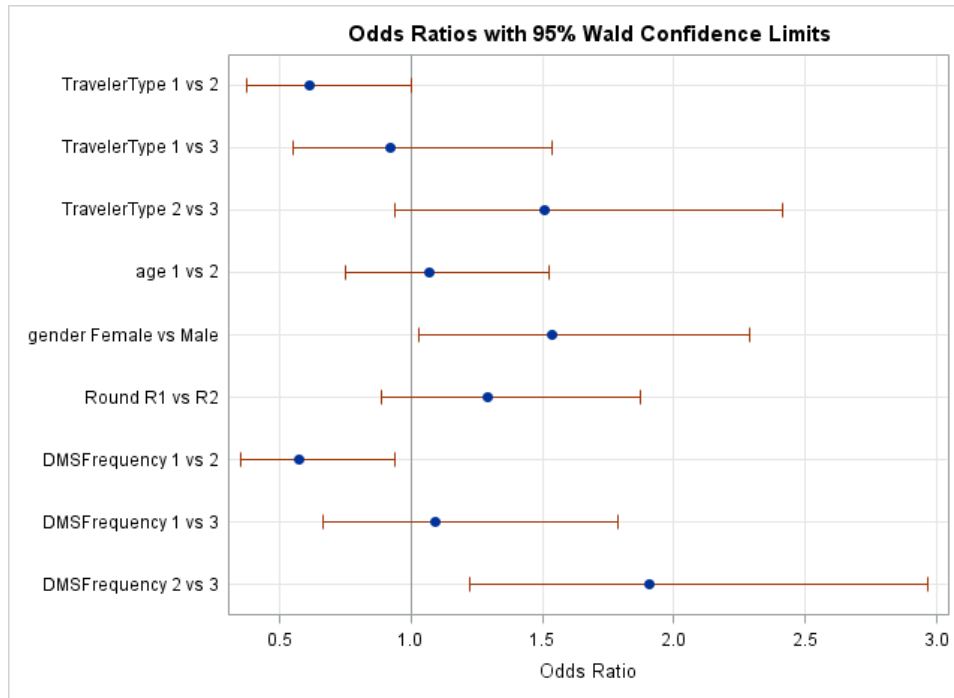


Figure C-21. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Whether DMS Messages Cause Changes in Driving Behavior in Nevada.

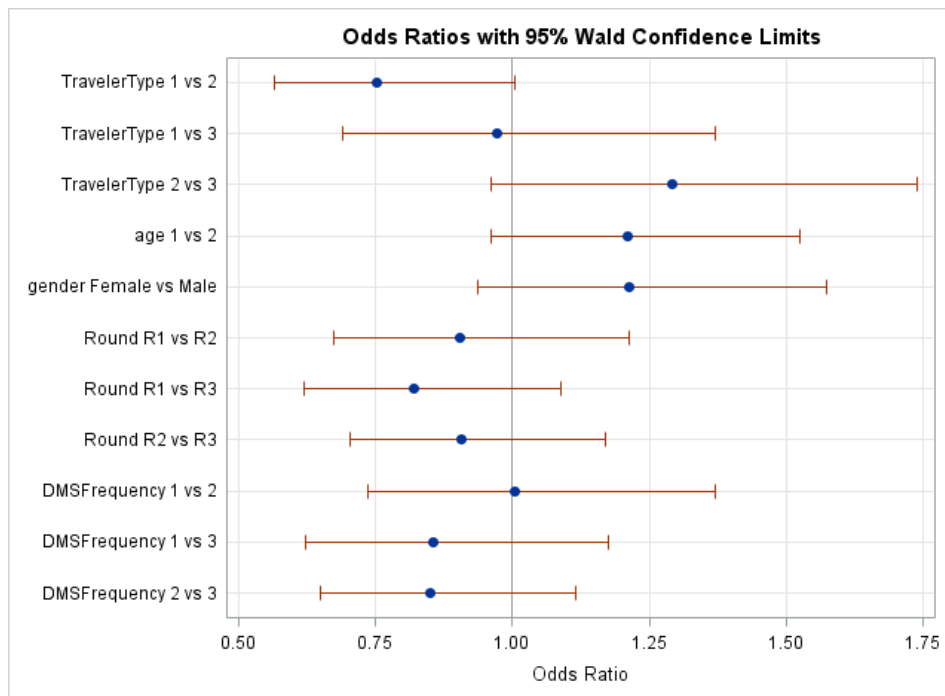


Figure C-22. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Whether DMS Messages Cause Changes in Driving Behavior in Minnesota/Wisconsin.

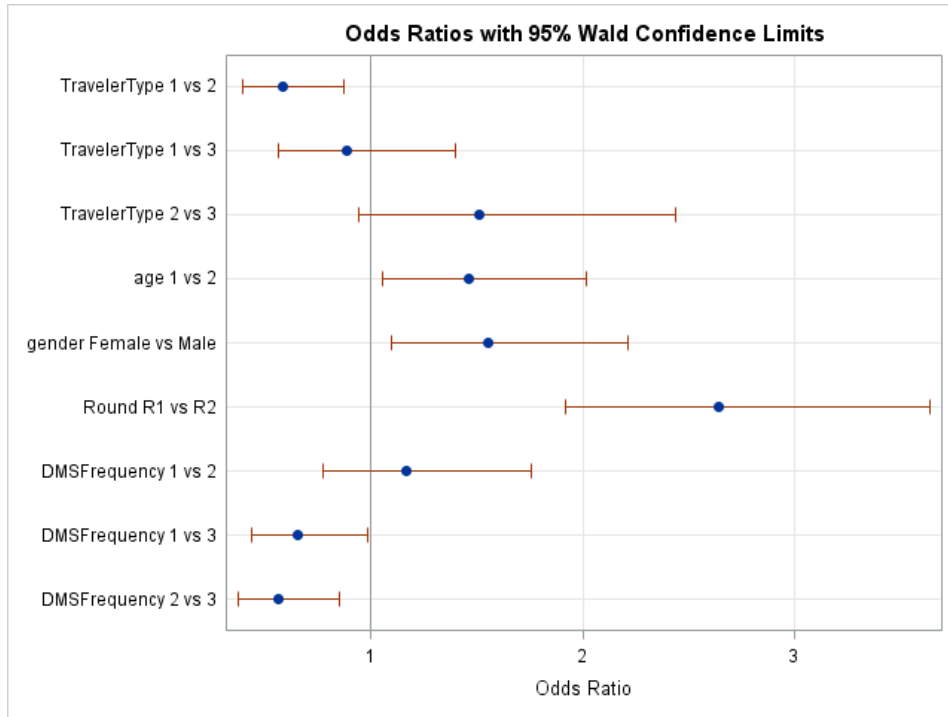


Figure C-23. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Whether DMS Messages Cause Changes in Driving Behavior in Kansas.

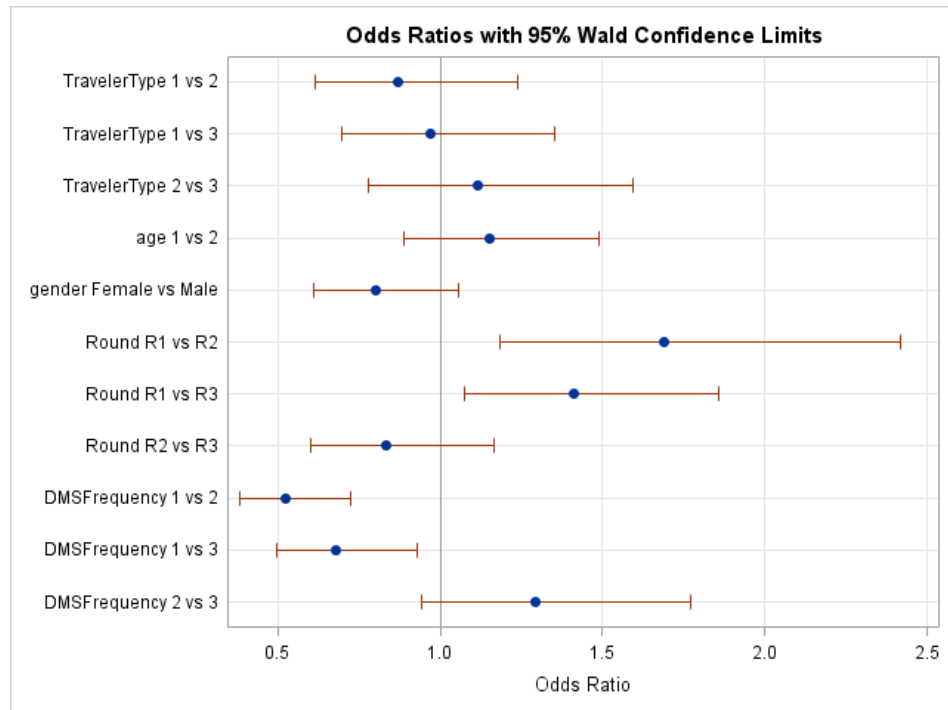


Figure C-24. Graph. Odds Ratios with 95 Percent Confidence Limits – Behavior Hypothesis on Whether DMS Messages Cause Changes in Driving Behavior in Missouri.

Figure C-25 through Figure C-28 present the odd ratios for each study corridor for the opinions hypothesis on traveler agreement that the identified message is appropriate.



Figure C-25. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on Agreement that the Identified Message is Appropriate in Nevada.

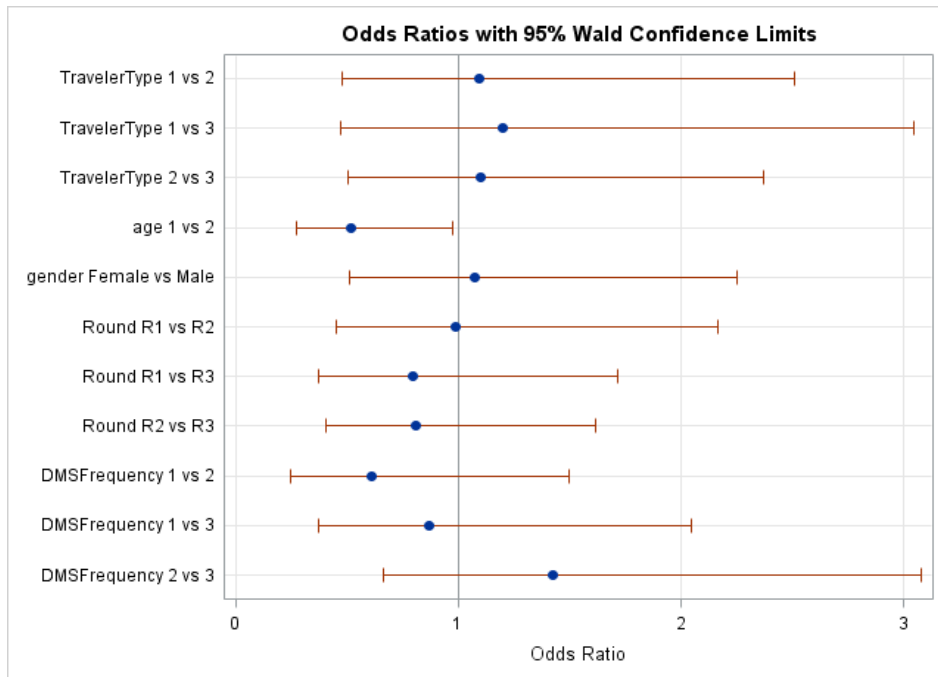


Figure C-26. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on Agreement that the Identified Message is Appropriate in Minnesota/Wisconsin.

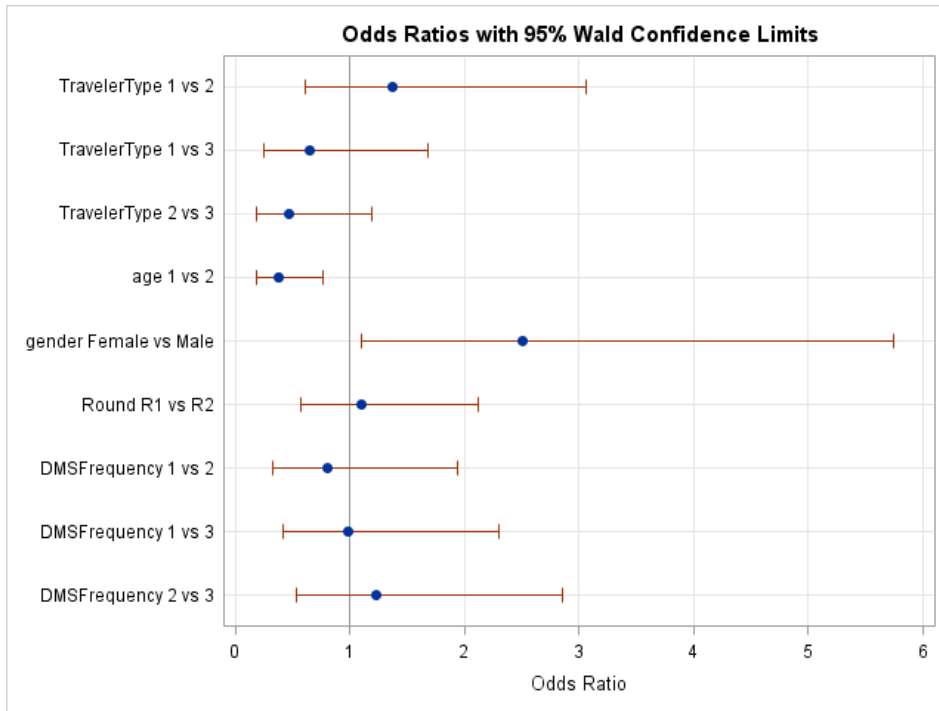


Figure C-27. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on Agreement that the Identified Message is Appropriate in Kansas.



Figure C-28. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on Agreement that the Identified Message is Appropriate in Missouri.

Figure C-29 through Figure C-32 present the odd ratios for each study corridor for the opinions hypothesis on traveler agreement that the identified message raised their awareness of the issue.



Figure C-29. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis that the Identified Message Raised their Awareness of the Issue in Nevada.

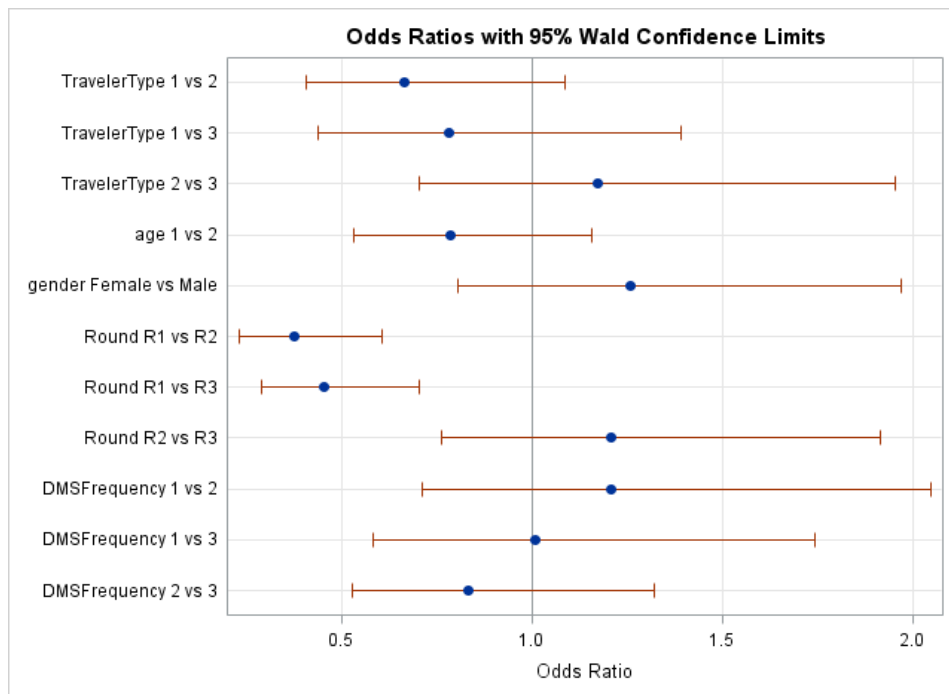


Figure C-30. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis that the Identified Message Raised their Awareness of the Issue in Minnesota/Wisconsin.

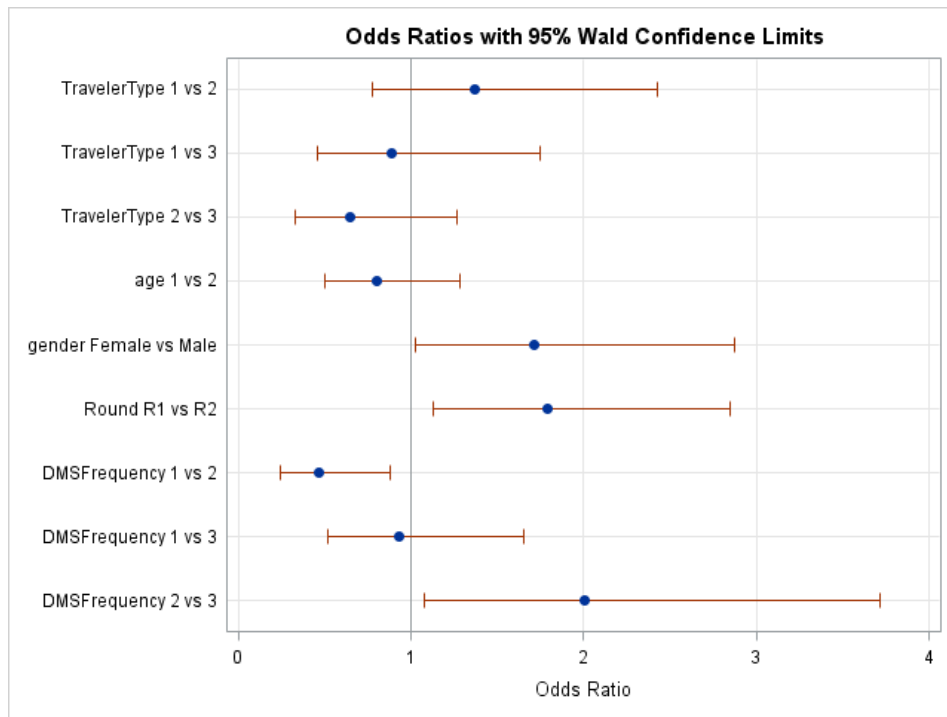


Figure C-31. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis that the Identified Message Raised their Awareness of the Issue in Kansas.



Figure C-32. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis that the Identified Message Raised their Awareness of the Issue in Missouri.

Figure C-33 through Figure C-36 present the odd ratios for each study corridor for the opinions hypothesis on the best way to communicate safety-related information.

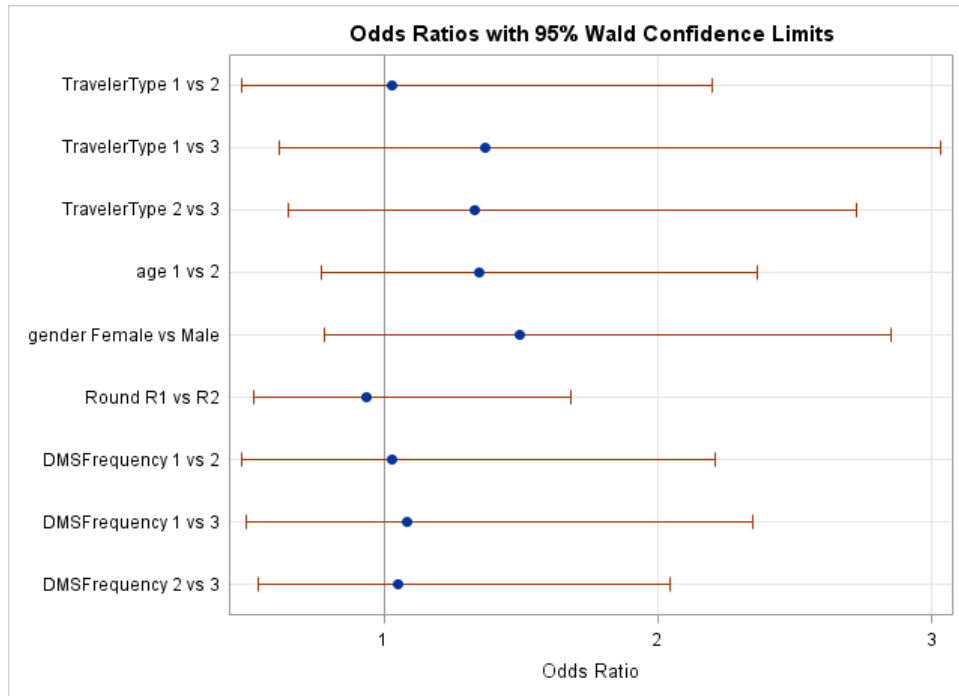


Figure C-33. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on the Best Way to Communicate Safety-related Information in Nevada.

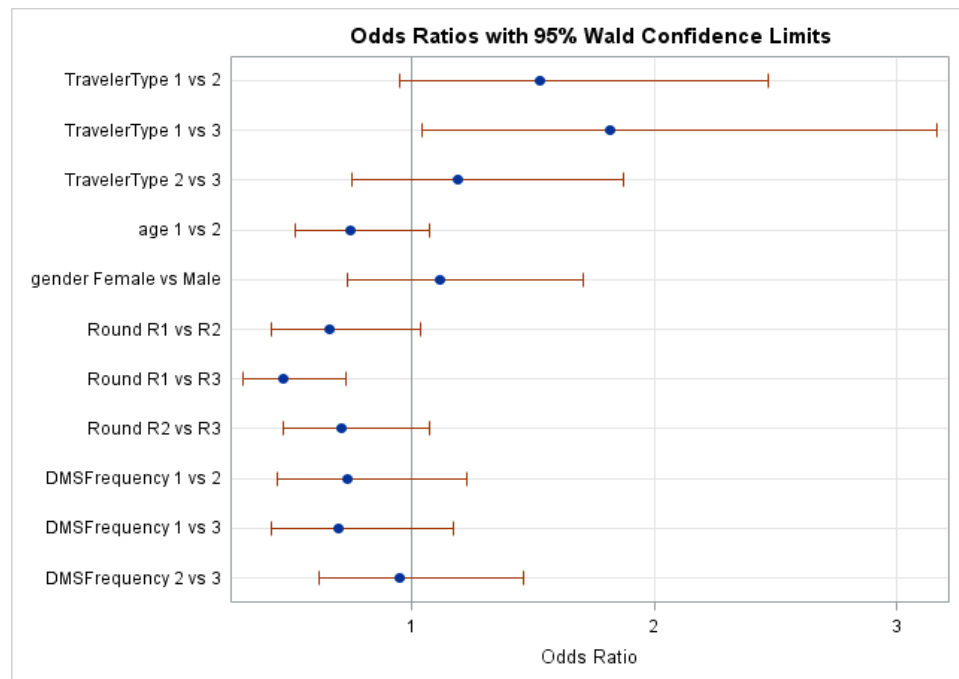


Figure C-34. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on the Best Way to Communicate Safety-related Information in Minnesota/Wisconsin.

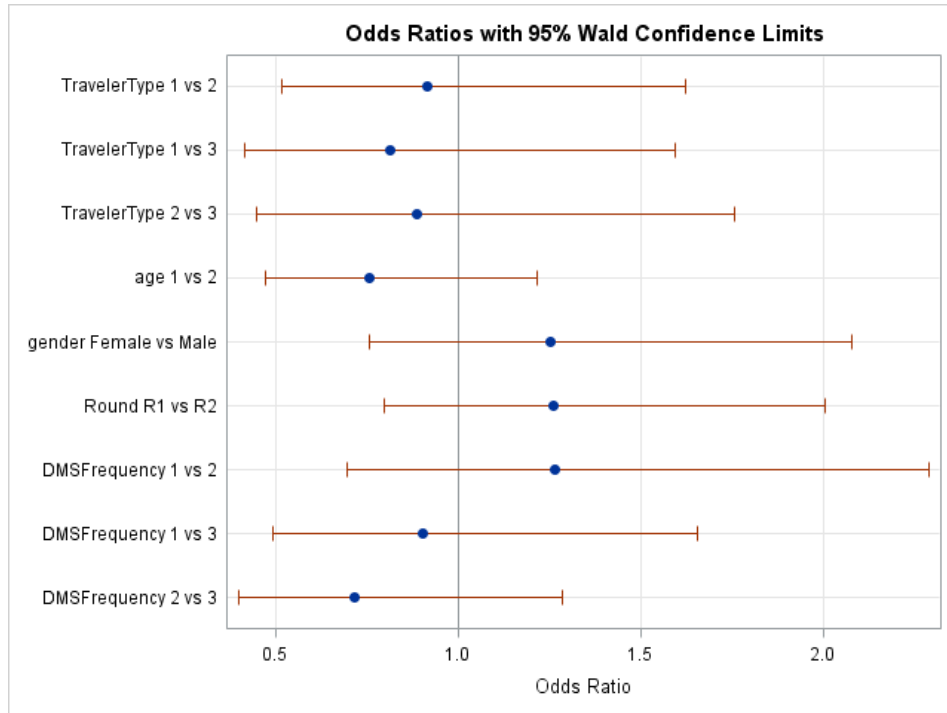


Figure C-35. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on the Best Way to Communicate Safety-related Information in Kansas.

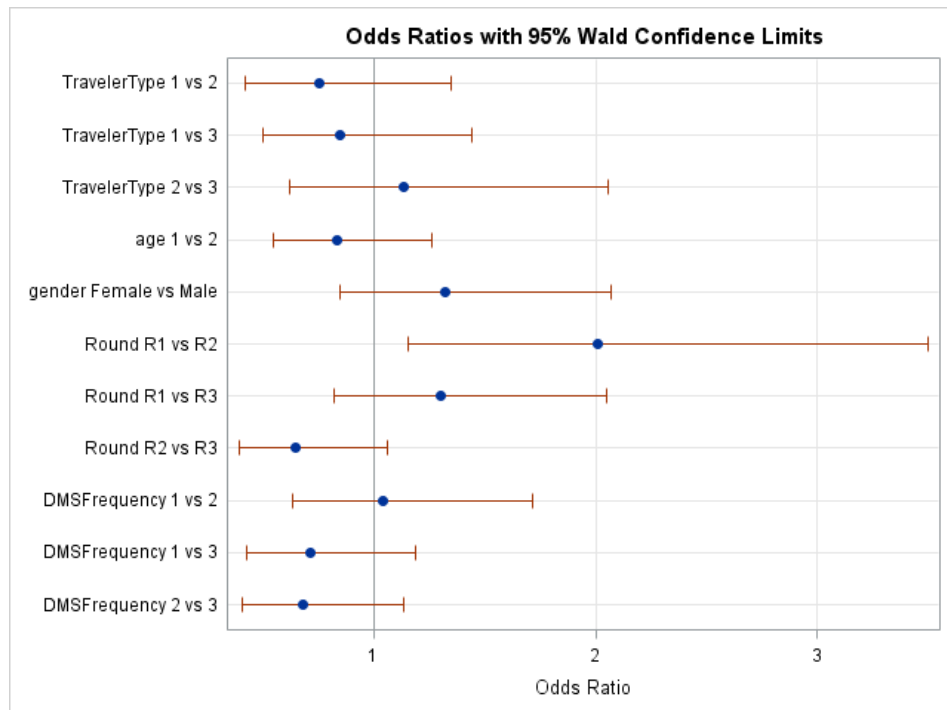


Figure C-36. Graph. Odds Ratios with 95 Percent Confidence Limits – Opinions Hypothesis on the Best Way to Communicate Safety-related Information in Missouri.

Figure C-37 through Figure C-40 present the odd ratios for each study corridor for the opinions hypothesis on message types that should be displayed on DMS.

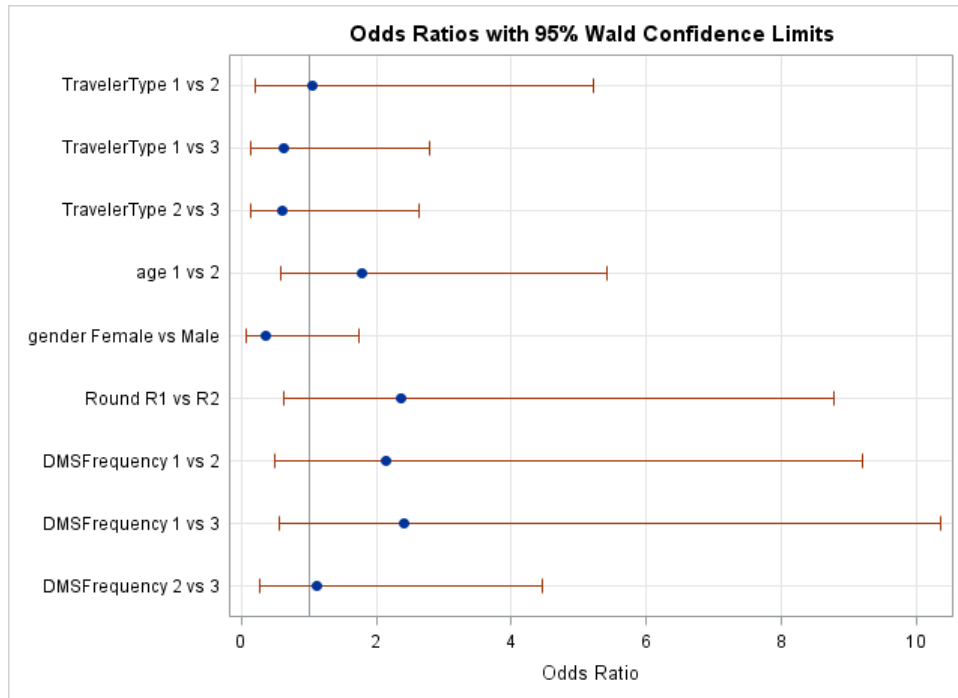


Figure C-37. Graph. Odds Ratios with 95 Percent Confidence Limits - Opinions Hypothesis on Message Types that should be Displayed on DMS in Nevada.

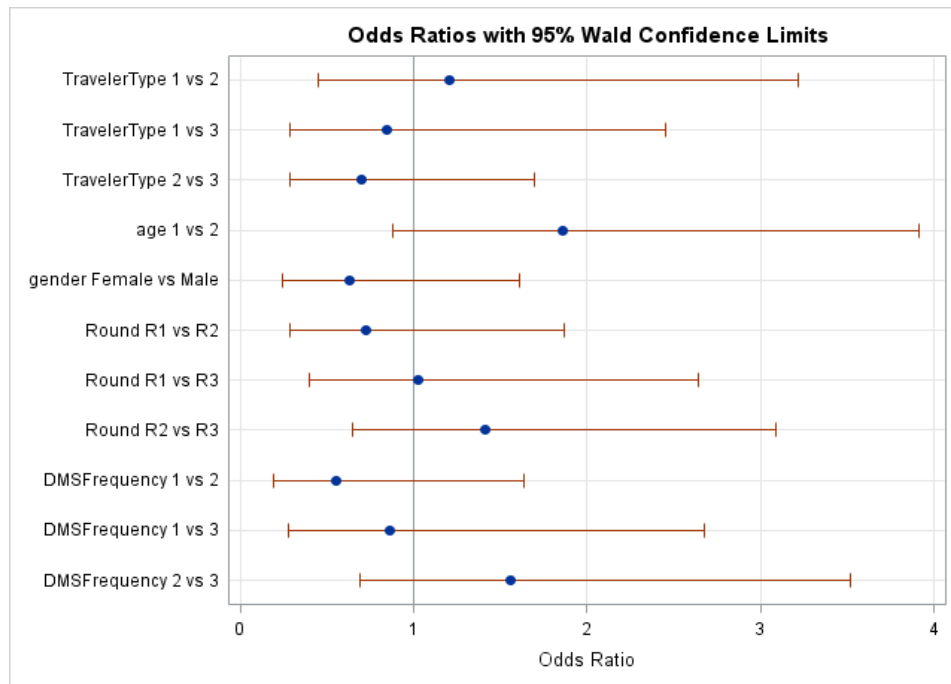


Figure C-38. Graph. Odds Ratios with 95 Percent Confidence Limits - Opinions Hypothesis on Message Types that should be Displayed on DMS in Minnesota/Wisconsin.

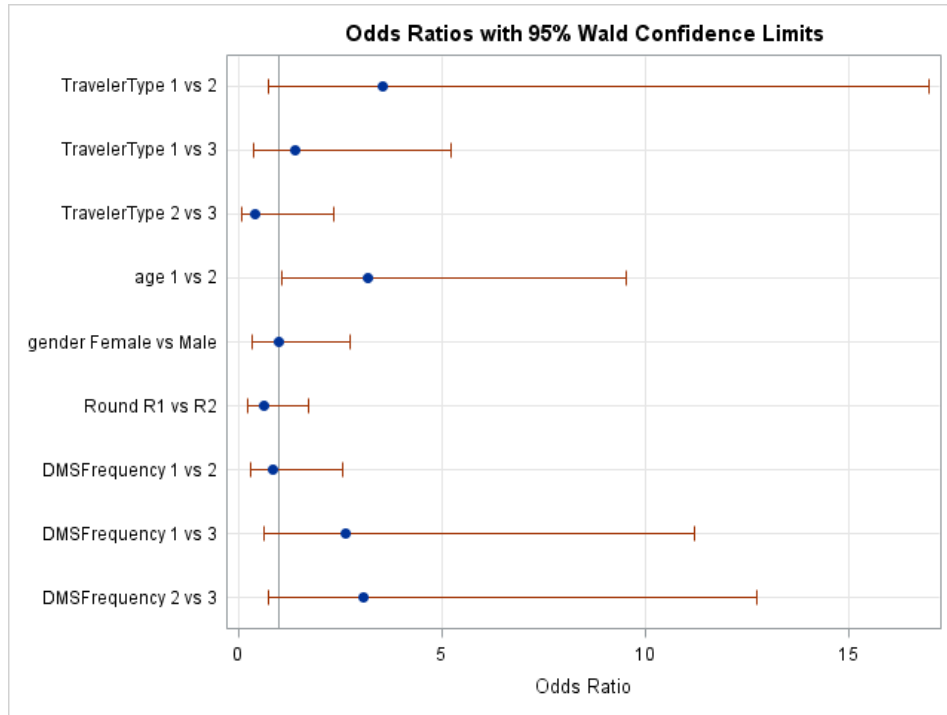


Figure C-39. Graph. Odds Ratios with 95 Percent Confidence Limits - Opinions Hypothesis on Message Types that should be Displayed on DMS in Kansas.



Figure C-40. Graph. Odds Ratios with 95 Percent Confidence Limits - Opinions Hypothesis on Message Types that should be Displayed on DMS in Missouri.

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